DESIGNERS' GUIDE ISSUE

APPLIED HYDRAULICS

FRANCHISE CIRCULATION

JANUARY 1957

THE MAGAZINE OF FLUID POWER / Air Circuits — Electrical Controls

Quick Guide to Product Selection

page 87

Air and Oil Circuits Guide

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For Information About
1957 PRIZE PAPER CONTEST
See page 82

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

GASOLINE
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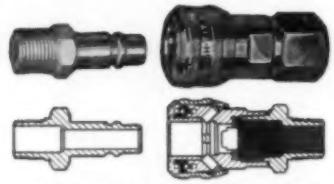

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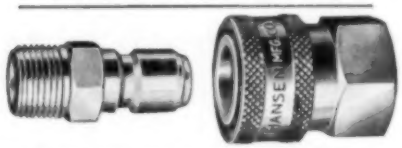

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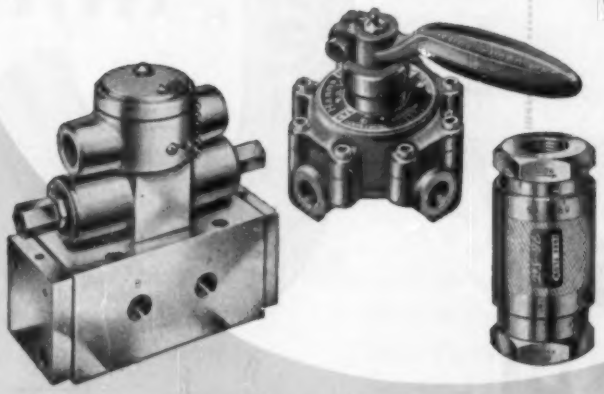

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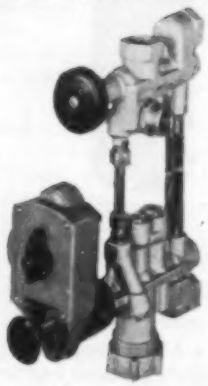

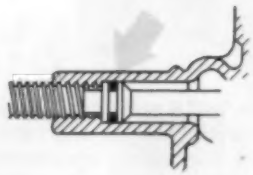

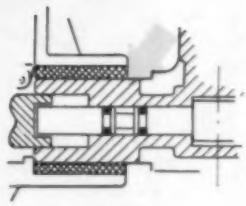

THE LINDSAY COMPANY, world's largest manufacturer of automatic home water softeners, uses three QUAD RINGS in its newest valve. Lindsay tested O-rings in the valve, but O-rings leaked at very low pressures. Then Lindsay tested QUAD RINGS, a revolutionary new seal originated and manufactured by Minnesota Rubber. QUAD RINGS sealed perfectly no matter how low the pressure. The Lindsay Company also found that it could open some of the tolerances on the valve parts—and save money—because QUAD RINGS give such a good seal with low friction.

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APPLIED
HYDRAULICS
THE MAGAZINE OF FLUID POWER

JANUARY 1957 • VOLUME 10, NO. 1

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Cylinders, Hydraulic
Filters, Compressed Air
Filters, Hydraulic
Fittings, Hose & Hose Assemblies
Fittings, Tube
Fluids, Hydraulic, Petroleum Base
Fluids, Hydraulic, Synthetic
Joints, Fluid Line
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Motors, Fluid, Vane Type
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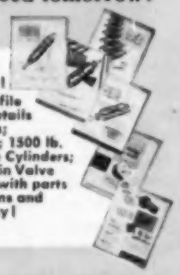

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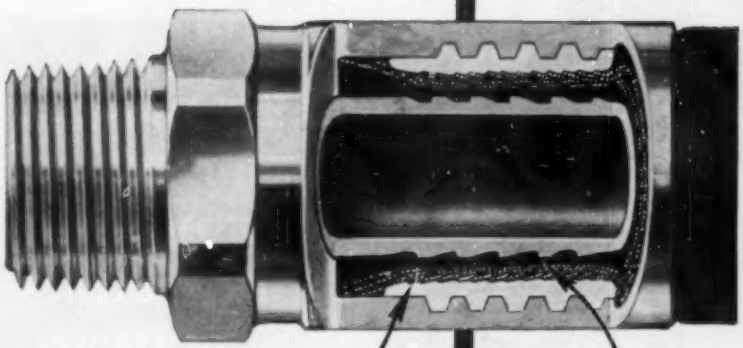

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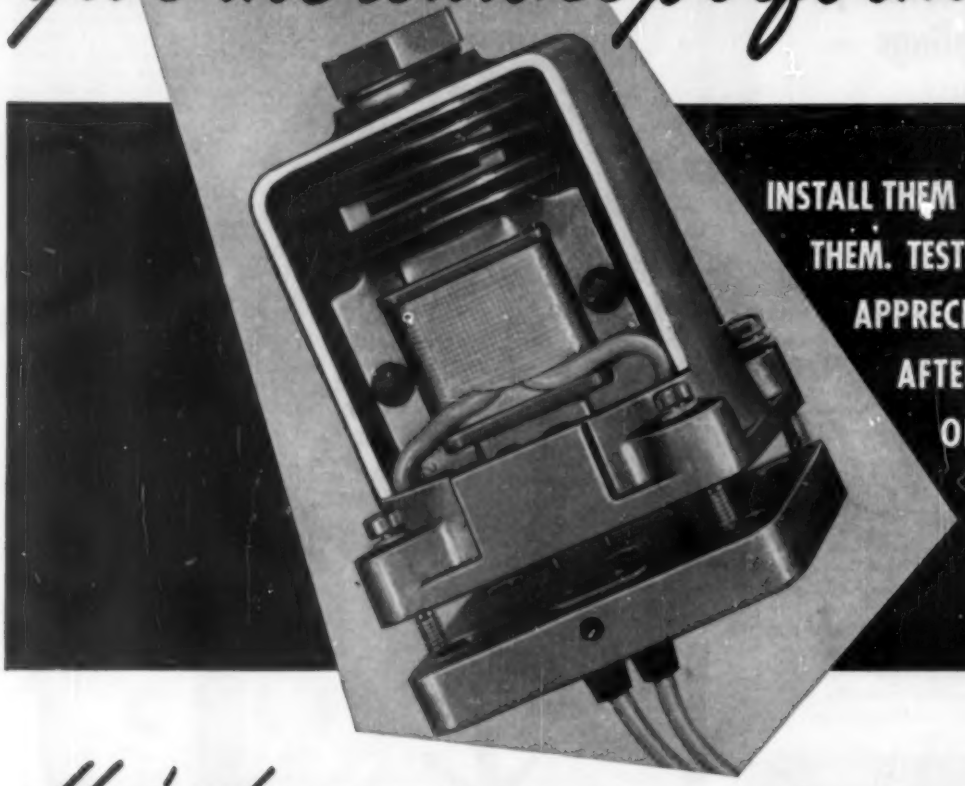

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about Applied Hydraulics

GROWTH INDUSTRY . . . This Designers' Guide Issue has been in the making for several years. Even longer when you realize that it has been made possible by the growth of the Fluid Power Industry over the last 10 years. An important factor is the present wide acceptance of a Fluid Power vocabulary and circuit language. We're proud of the part AH has played in making this "vocabulary" a common language among design engineers, production and management people.

There is much still to be done to define the fluid power language and make it known to all of industry. This Designers' Guide Issue is a giant step.

Can you visualize what an incomprehensible maze the Circuits Guide Section would be if it were prepared 10 years ago before JIC symbols were even suggested?

More than 1000 product selection factors appear in the Guide Section of this issue. AH editors did much consulting with industry; sorting and sifting to come up with widely accepted terms. This would have been impossible to do a few years ago.

STATISTICS . . . On December 3rd, we accepted the last selection sheet which product manufacturers filled out to supply information for the Quick Guides to Product Selection. Here's a box score: Starting about October 1st, we sent 1029 different product questionnaires to 519 companies. 424 companies returned 892 product questionnaires. This is a return by 81.8% of the companies and 86.5% of the questionnaires.

TELL US, PLEASE . . . This Designers' Guide Issue is prepared to help you quickly select the most likely sources of supply for a fluid power product. Obviously, the next step from the Quick Guide Charts is to the manufacturer's ad and literature. The Guide Charts really give you an index to a "mile-high" stack of product information.

On many of the returned questionnaires, excellent suggestions for improvement of our charted characteristics were made. Some we were able to include in this issue. Others we had to set aside for action next year because our mailings, art-work, etc. had gone beyond the "point-of-no-return" for this issue.

For this first issue we concentrated on the major products in the field. There are others which we plan to include next year and the years after, if your response to this issue is favorable. We are anxious to have your opinion and suggestions.

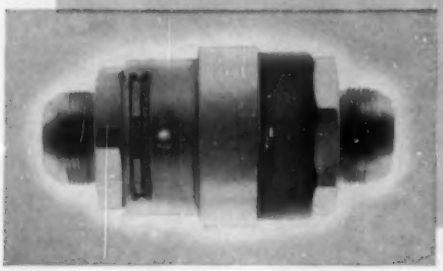
EXTRA COPIES . . . One way we'll be able to measure the value of this issue is by requests for additional copies. We'll have them available. Price per copy is 50 cents.

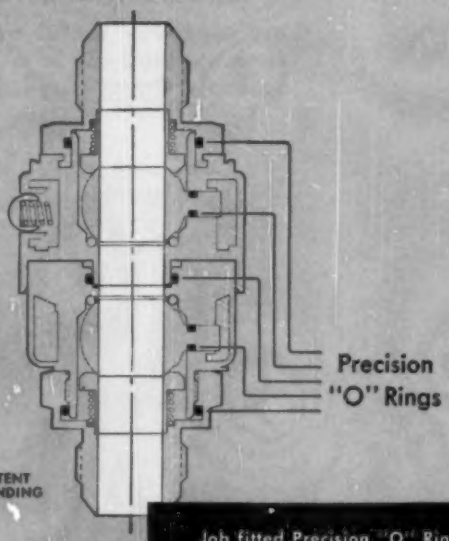
CIRCUIT GUIDE . . . The 32 page circuit guide in this issue is a revised version of FLUID POWER CIRCUITS we published in January 1954. Thousands of the original booklet were sold. Because so many requests for copies could not be filled, we corrected added to and we believe, greatly improved this basic circuit information. Reprints can be ordered. Minimum quantity is 10 copies. Cost: 10 to 99 copies, 50 cents each; 100 and over 35 cents each.

ZERO LEAKAGE

Precision "O" Rings answer another sealing problem

Precision "O" Rings in the Eastern Aircraft quick disconnect coupling seal perfectly under pressure of 4000 P.S.I. and over the temperature range of −65° to 275°F.





Job fitted Precision "O" Rings have solved hundreds of other industrial aircraft and automotive sealing problems.

Rigid quality controls maintained at Precision are paying off both for Precision and their customers. A case in point is the development of a quick disconnect coupling by Eastern Aircraft Products Corporation of Orange, New Jersey. Precision engineers developed "O" Ring compounds for these straight through couplings which eliminate pressure drop, and provide zero leakage. The result—a super quick, self-sealing, trouble-free coupling sealed at both ends for the aircraft, petroleum and chemical industries.

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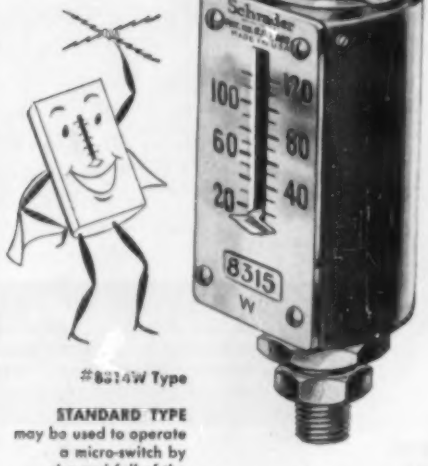

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STANDARD TYPE may be used to operate a micro-switch by rise and fall of the plunger to start another sequence, etc.

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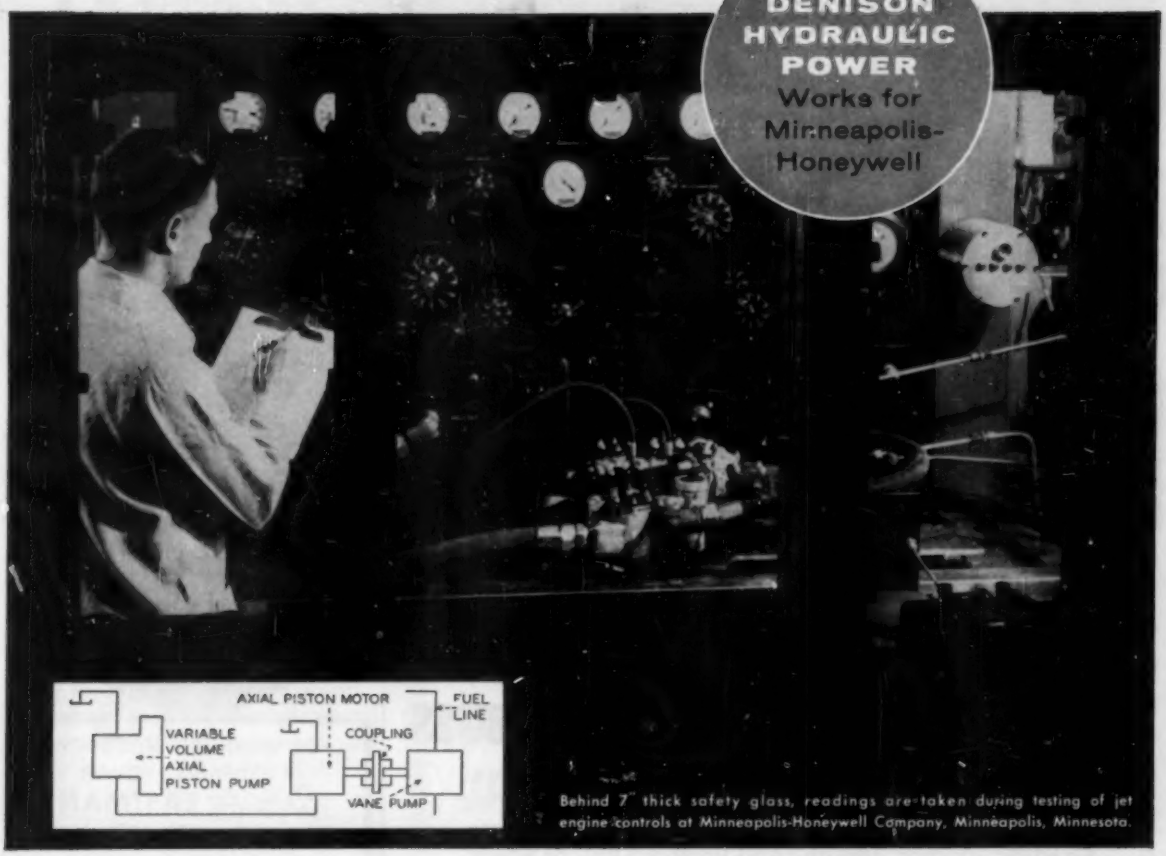
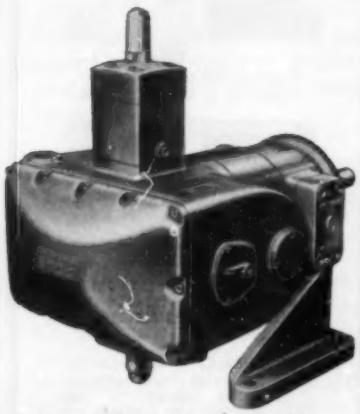


Behind 7" thick safety glass, readings are taken during testing of jet engine controls at Minneapolis-Honeywell Company, Minneapolis, Minnesota.

Providing the muscle power for a "ghost" engine



Denison Variable Volume Axial Piston Pump remote controlled.

A unique electronic system developed by Minneapolis-Honeywell to pre-test jet engine controls now eliminates the cost of building and operating a special engine test cell. The system actually produces a more accurate record of performance than would be possible if the actual engine were used.

The system works this way. An analog computer takes the place of the jet engine. Performance data and other characteristics are received from the manufacturer. These are then simulated on the computer and reproduced as electrical signals, which, in turn, run the engine controls.

To provide dependable muscle power for this control system, Minneapolis-Honeywell relies on Denison hydraulic pumps and motors. The key unit, a Denison Variable-Volume Axial Piston Pump is the prime mover for a Denison axial piston motor that in turn powers a Denison vane pump to deliver jet fuel.

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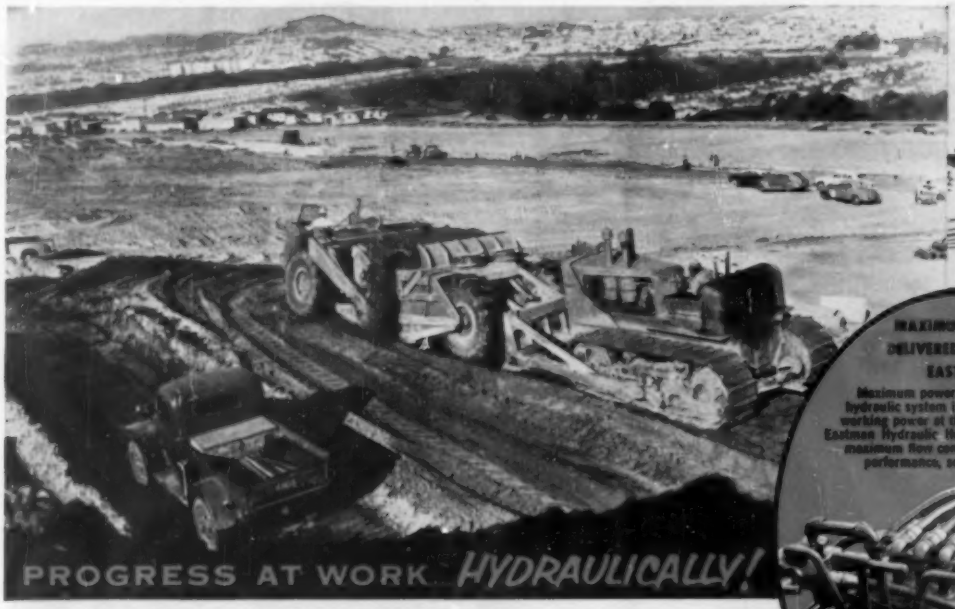
HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

DENISON Hydr**OIL**ics



America's Future Lifeline of Travel

MAXIMUM POWER DELIVERED THROUGH EASTMAN
Maximum power delivery for every hydraulic system is the key to efficient working power at the point of operation. Eastman Hydraulic Hose Assemblies provide maximum flow consistent with efficient performance, service and safety.

SMOOTHER AND SAFER ROADS ARE BEING BUILT FASTER... THROUGHOUT AMERICA *with*

HYDRAULIC POWER delivered thru

EASTMAN HYDRAULIC HOSE ASSEMBLIES

Modern Hydraulics will put millions of horsepower to work building America's roads . . . maneuvering mighty earth-moving machines with finger-tip ease. Grading, loading, leveling and finishing will be easier, more economical—saving time, money and manpower.

Many Pioneer Manufacturers of modern road building equipment have, from the beginning of hydraulics—equipped their machines with Hydraulic Hose Assemblies made by the very first pioneer manufacturer in this field—EASTMAN of Manitowoc, Wisconsin.

Eastman's Continued Leadership has been maintained through advanced engineering and design—plus materials and workmanship which are so high that they are accepted by many Original Equipment Manufacturers as the *standard for the industry!*

Eastman Is Geared to supply the critical demand for performance-tested Hydraulic Hose Assemblies which will more than meet the roughest road building construction hazards. Many 'round the clock operations will now run into year-'round schedules, and Eastman's new production facilities stand ready to provide *dependable shipments, service and satisfaction.*

FOR INCREASED EFFICIENCY IN HYDRAULIC POWER
Specify EASTMAN
HYDRAULIC HOSE ASSEMBLIES

EASTMAN'S NEW "HI-FLO" COUPLING DELIVERS A MAXIMUM OF POWER

EXCLUSIVE GRIP ADVANTAGES WITH INTER-LOCK ® CLAMP COUPLING

CUT COSTLY "DOWN-TIME" WITH EASTMAN RE-USABLE COUPLINGS

ADAPTERS AND ADAPTER UNIONS, STRAIGHT, ANGLED, TEES FOR HOSE ASSEMBLIES AND RE-USABLE COUPLINGS

BULKHEAD "O" RING ADAPTERS, HYDRAULIC TUBE FITTTINGS, UNIONS, ELBOWS, "O" RING ADAPTERS AND LOCKNUTS FOR ALL HOSE ASSEMBLIES, RE-USABLE COUPLINGS

Eastman
first in the field
MANUFACTURING COMPANY
Dept. AH-1, Manitowoc, Wis.

SEE YOU AT THE ROAD SHOW
JAN. 28th-FEB. 2nd
BOOTH 359, SECTION A
(North Hall—2nd Floor)

WRITE **for bulletin to suit your needs or send specifications**

Circle 59 on Reader Service Card

LETTERS
to the editor

Address your letters to: Editor, APPLIED HYDRAULICS Magazine, 812 Huron Rd., Cleveland 15, Ohio.

Component Suppliers

Can you furnish sources for sealed systems circuitry and component suppliers? We are particularly interested in low volume, 2 gpm, and low-pressure, 150 psi ranges.

K. M. GEBEL
Landis Tool Company
Waynesboro, Pa.

We are not sure we understand what you mean by sealed system circuitry. Most manufacturers supply individual components which can be made into a circuit package. Many make an integrated package. Any issue of APPLIED HYDRAULICS *magazine will give you information on these components. We are enclosing a brochure describing the* MASTER CATALOG OF FLUID POWER PRODUCTS, *which would be very helpful to you in selecting hydraulic systems.*

Reprints

Do you have available a reprint on the "Beginner's Course in Basic Pneumatics"? What reprints are available in design and application of pneumatic and hydraulic equipment?

T. G. NESSLER
Mechanical & Material
Engineers Standards
Radio Corporation of America
Camden, N. J.

Reprints of this "Course" are no longer available. At present no list of reprints is available on articles published in APPLIED HYDRAULICS. *We can usually supply single copies of any article which has appeared within the past 24 months, and sometimes even farther back. We have sent a brochure on the* MASTER CATALOG OF FLUID POWER PRODUCTS, *which will be of interest to you.*

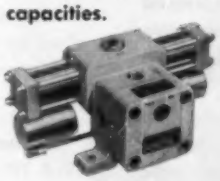
Continued on page 16

it's just that SIMPLE

You can convert all of your line valves for automatic control simply by equipping them with Ledeen Valve Actuators—easily and quickly done in the field without interruption of service or modification of plug valves.

Pneumatically or hydraulically operated, these valve actuators are adaptable to gate, diaphragm and plug valves for direct or remote control.

Ledeen Valve Actuators are available in a wide range of torque capacities.

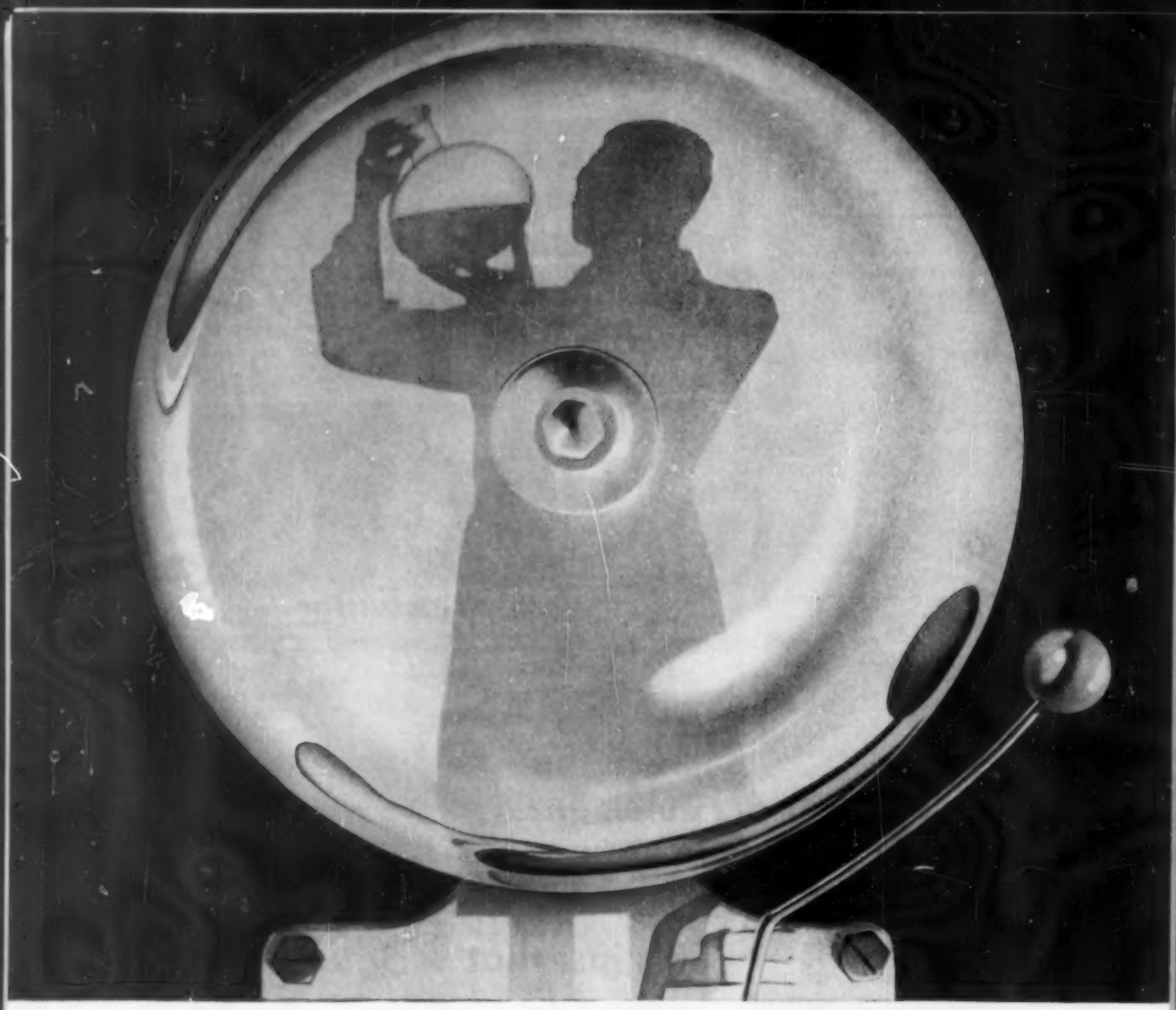


Control your Ledeen Actuators with Ledeen Valves

Write for Bulletin 3020

VALVES • CYLINDERS
VALVE ACTUATORS
AIR-HYDRAULIC PUMPS
AND BOOSTERS

Ledeen Mfg. Co.
3332 North Gilman Road
El Monte, California



matching wits with fire

Fire-resistant Celanese Cellulubes provide protection against the costly damage of fires and explosions.

When employed as the hydraulic fluid in die casting and similar critical operations, Cellulubes reduce the ever-present danger of uncontrollable fires caused by line breaks or other equipment failures. As air cylinder lubricants in compressed air systems, Cellulubes prevent the formation of excessive carbon deposits—the main source of compressor fires and explosions.

Possessing stable physical properties, Celanese Cellulubes provide high performance and safety during continuous duty under critical conditions. This stability contributes to the fluid's longer life, an economy factor further enhanced by the fluid's reusable property, permitting reuse of spillage. Straight phosphate esters, Cellulubes contain no additives. They're non-reacting, non-carbon-forming, non-corrosive, fire-resistant chemical compounds with excellent lubricity.

Available in 6 controlled viscosities, Cellulubes can be supplied by Celanese to meet exacting requirements in the replacement of flammable fluids presently in use. Play it safe, write for complete data and technical assistance.

Celanese Corporation of America, Chemical Division, Dept. 588-A, 180 Madison Avenue, New York 16, N. Y.

Basic reasons.....

Acids
Alcohols
Aldehydes
Anhydrides
Esters
Functional Fluids
Gasoline Additives
Glycols
Ketones
Oxides
Polyols
Plasticizers
Salts
Solvents
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Celanese
CHEMICALS

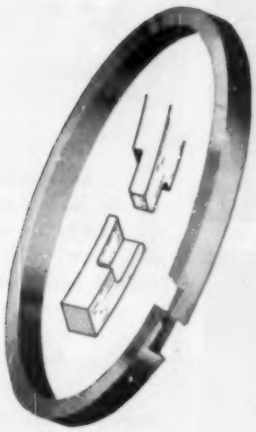
.....for improved products

Agricultural, automotive, aviation, building, electrical, paper, pharmaceutical, plastics, surface coatings, textile.

MEANT FOR EACH OTHER—

COOK Hydraulic Piston Rings

and Your Cylinders!



COOK SEAL-JOINT HYDRAULIC RING TYPE 101-SS

Diameter Range—3" to 60"

Unique, single-acting sealing ring for use in all grooves.

Seal-joint construction provides unbroken sealing surfaces against both cylinder wall and groove land.

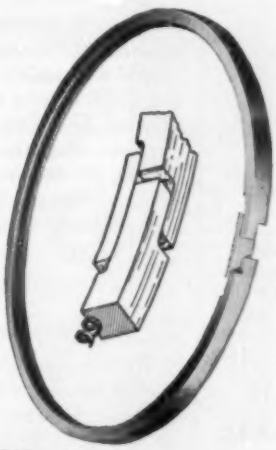
Less rings per piston are required because leakage through plain-ring gaps is eliminated.

One-piece construction insures easy installation.

WHATEVER your hydraulic piston-ring requirements, there's a C. Lee Cook ring to fill the bill. Each is carefully inspected to assure extremely close tolerances on roundness, circularity and other physical dimensions.

Because Cook Hydraulic Piston Rings are *built* better, with better *materials*, they provide longer ring life, reduce the rate of cylinder wear and eliminate cylinder scoring. They're available in sizes from 1½" to 60"—in exclusive Cook Graphitic Iron, bronze and special materials.

For prices and a copy of our new Design Chart, HYD-2810, containing recommended dimensions of rings and grooves, write to Hydraulic Dept., C. Lee Cook Company, 930 South Eighth Street, Louisville 3, Kentucky.



COOK GAP-SEAL HYDRAULIC RING TYPE 301-1X

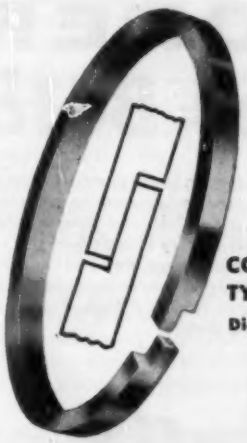
Diameter Range—3" to 60"

Complete flexibility assures perfect wall contact at all times. No wear-in period required.

Sealing is double-acting. Makes ring ideal for all services and simplifies installation.

Seal is complete at all points. Step-cut construction seals joint contact with cylinder. Special over-lapping gib seals joint at groove sides.

Spring actuation is independent of groove bottom. Assures uniform distribution of tension.



COOK STEP-CUT RING TYPE 101-1

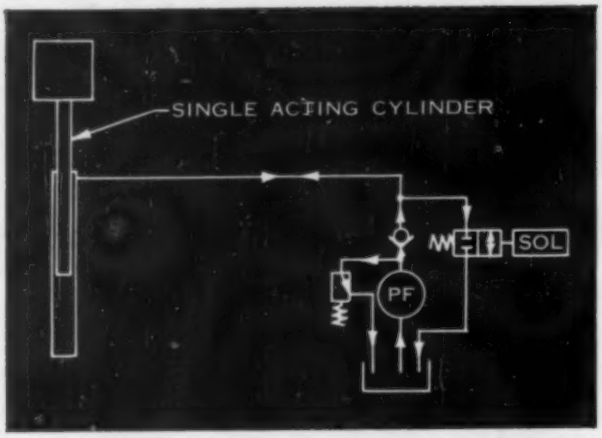
Diameter Range—1½" to 60"

C. LEE COOK COMPANY

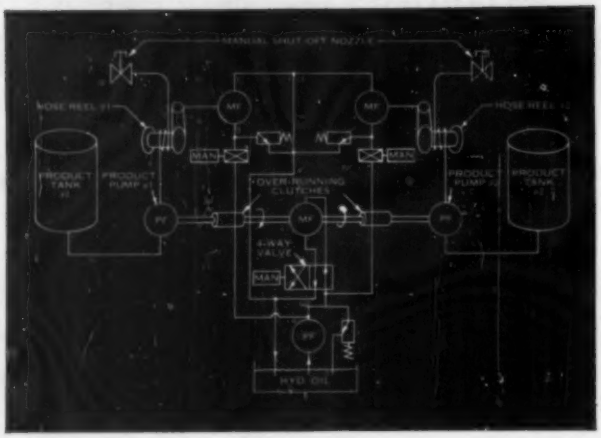
A Subsidiary of Dover Corporation

Sealing Pressures Since 1888

SIMPLE CIRCUIT



COMPLEX CIRCUIT



ROPER
Serves Both Best

The key to any hydraulic system is the pump. It must have the proper characteristics in relation to the other equipment in the circuit — whether simple or complex. It must also be *dependable* and have the *stamina* to provide long and trouble-free service. Roper Rotary Pumps *have* the attributes that are so necessary to effect optimum performance, and you can count on them for successful control of circuits involving either tons or pounds. On your next hydraulic problem, investigate Roper Rotary Pumps. Find out how they can be the key to a dependable hydraulic system.

PUMPS TO 1000 P.S.I.

•

HYDRAULIC PUMP-MOTORS

High Torque Low Speed
Up to 11.5 H.P. output

SEND FOR CATALOG AND BULLETIN 22

GEO. D. ROPER CORPORATION
701 Blackhawk Park Avenue
Rockford, Illinois

ROPER
Rotary Pumps

LETTERS to the editor

Back Copies

Please send us copies of the last 12 issues of APPLIED HYDRAULICS.

KURT F. ZIEHM, JR.
President
Precision Extrusions, Inc.
Bensenville, Ill.

We are sending you as many of the back issues, from the last 12 months, as are available. Cost per issue is 50 cents. Sorry we cannot send you a complete set.

NCIH Papers

Please advise the cost and procedure for procuring a copy of the complete NCIH paper on "Design Factors Involved in a high Pressure Air Coal Blasting Method" presented at the National Conference on Industrial Hydraulics in October.

D. M. MCDOWELL
Chief Development Engineer
Le Roi Division
Milwaukee, Wis.

All papers presented at the NCIH will be published in the conference "Proceedings" which should be available about February 1957. Copies of the Proceedings can be ordered from the Conference Secretary, Raymond Meade, Illinois Institute of Technology, Chicago, Illinois. Price will probably be the same as last year, $5.00.

High Pressure Valves

We are interested in sources for special valves for 3200 psi oil and 4500 psi air pressures, with flow at 20 gpm hydraulic and 300 cfm for air.

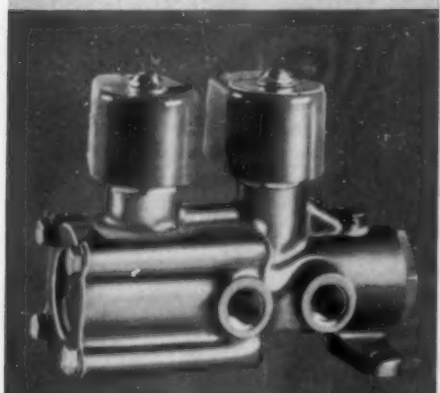
F. E. HORSLEY
Diesel Injection Sales and Service, Inc.
Norfolk, Va.

You describe solenoid operated on-off valves, signalled by a pressure switch sensing pressure drop on the downstream side of the valve. Your pressure requirements are quite high, and it is doubtful whether any manufacturer has

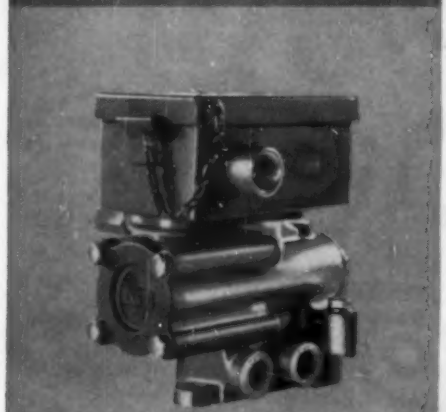
Continued on page 18

Now available: full line of ASCO 4-way solenoid valves

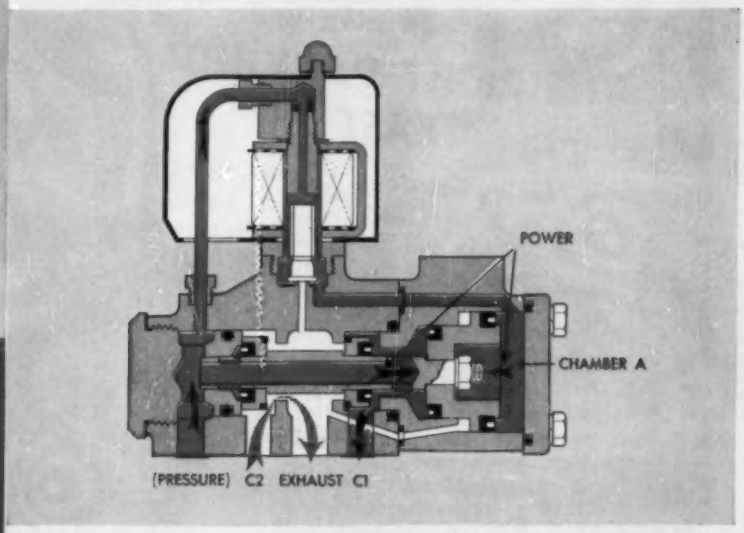
Single Solenoid: operates when solenoid is energized; returns automatically when de-energized.



Dual Solenoid: operates when either solenoid is energized; will not return until opposite solenoid is energized. Solenoids may be energized continuously or momentarily.



J.I.C. Construction: single and dual solenoids, with sub-plate mounting.



power driven in both directions by line pressure

Now available in ⅜" through 1" sizes, these valves are positive in action. When the solenoid is de-energized, *line pressure* applied to the top of the pilot core forces it off the seat, eliminating possible sticking caused by residual magnetism. *Line pressure* is applied to Chamber A, moving the piston-disc assembly to the left. When the solenoid is energized, Chamber A is exhausted and *line pressure* drives the piston to the right.

absolutely tight seating — no leakage

Combination of metal to metal and resilient seating provides dead tight shut-off — even on air. No grinding, lapping or close adjustments are necessary.

Available in standard, watertight or explosion-proof solenoid enclosures, the Bulletin 8344 permits cycling rates to 850 per minute — mounted in any position. Design simplicity eliminates maintenance problems.

J.I.C. construction available

These 4 way valves are available in all sizes to meet J.I.C. (Joint Industry Conference) standards. Valves are provided with sub-plates, vapor-proof solenoid enclosures, and manual overrides, and are electrically inoperative when the cover is removed.

New ASCO Condensed Valve Catalog No. 201 is now available. Write today for this basic reference on solenoid valves.

Important announcement . . . *new ASCO plant now being built in Florham Park, N. J., will double production capacity and greatly extend the range of our research, product development and services.*

AUTOMATIC TRANSFER SWITCHES
SOLENOID VALVES ELECTROMAGNETIC CONTROL

Automatic Switch Co.
385-H Lakeside Avenue, Orange, N. J. • ORange 2-5300

ASCO

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THE RIGHT PACKINGS
FAST
Engineering Service • Large Capacity
Page will give you helpful, intelligent engineering service . . . take your packings problem from its present stage and help you arrive at the best packings for your purpose. Their recommendations are based on three-quarters of a century of experience and know-how, backed by laboratory and testing facilities . . . and a plant that can turn out your packings by the thousands.
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Engineered to do a better job

LETTERS to the editor

this as standard. We suggest you contact Atkomatic Valve Company, who make a 3000 psi valve of stainless steel.

Can any of our readers suggest another source?

Books on Hydraulics

I would like to have a list of books relating to the field of hydraulics. Also, do you know of colleges or schools giving specific courses in hydraulic equipment?

ROY K. RILEY
Unit Manufacturing Company
Minneapolis, Minn.

We are sending you a copy of the January 1956 issue, which provides an index to all available literature in this field. Sorry, we don't know of any school in your area offering a course in hydraulics.

Fluid Characteristics

I would like a copy of the "Applied Hydraulics Data List", tabulating characteristics of the various commercial hydraulic fluids.

BILLIE H. SHEVICK, M. D.
Deere & Company
Moline, Ill.

The fluid selection guide in this issue will help you. More specific data can be obtained from the fluid suppliers.

Swivel Joints

We urgently require some universal joints for high pressure hydraulic connections on die-casting machines. These should be steel knee joints to connect with straight pipes.

GEORGE E. MOORE
Engineers, Designers and Consultants
Edgbaston, Birmingham,
England

Several manufacturers in the United States can supply you with swivel joints. These are widely used on die-casting machines for high pressure hydraulic connections. Check the Fluid Line Joint Guide in this issue.

Continued on page 20

Circle 134 on Reader Service Card

Circle 58

AIRCRAFT-TYPE
hydraulic
POWER UNITS . . .

To supply dependable hydraulic power for critical applications, Eastern units are engineered to perform under extreme conditions. Compact design and varying motor sizes make them unique power sources, especially desirable for airborne use. The equipment illustrated in detail presents a typical Eastern Power Unit designed for one application. Many other requirements can be satisfied with designs of this general type.

Unit consists of: positive-displacement pump, electric motor drive, oil reservoir, expansion chamber, porous bronze ten-micron filter, pressure regulating valve, filter relief valve, and expansion relief valve.

SPECIAL UNITS to be built into Servo Systems and specialized projects are available. As illustrated below, Actuators combined Servo-valve and Actuator, and Servo-valve Hydraulic System combinations are being produced by Eastern for custom-specified jobs. If your project involves equipment of this type, write to us for further information.

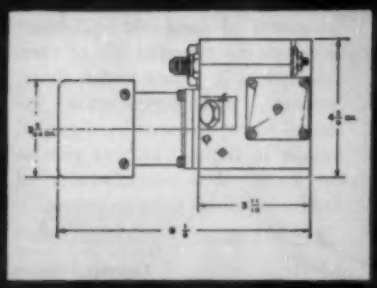
Specifications:

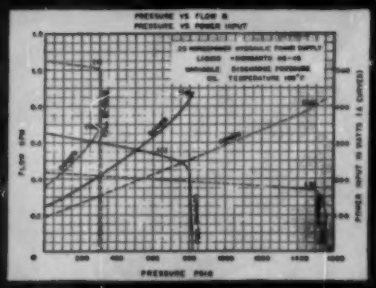
Available with either ⅛, ¼, or ½ horsepower motor, in 28 V. D.C. or 400 Cycles 3 Phase power.

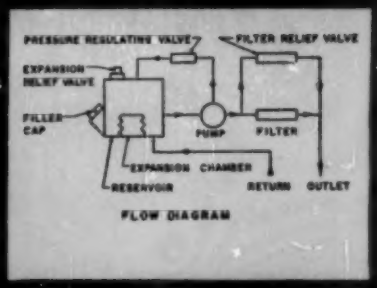
Available with various pump characteristics. Under certain operating conditions, units can be made self-cooling. *Example:* ¼ H.P. Unit has a continuous-duty oil-temperature rise above ambient of approximately 60° F. at sea level.

Pressure range from 0 to 1500 PSIG with compatible flow.

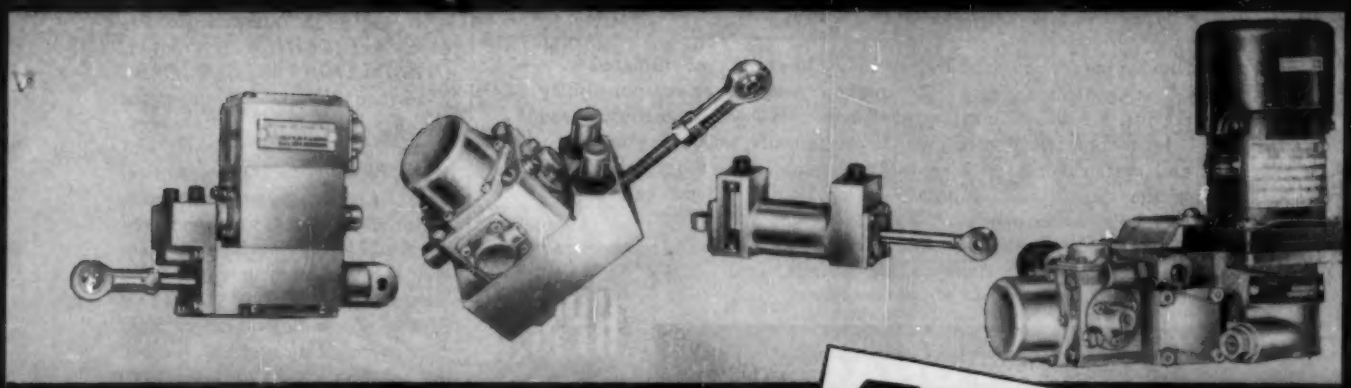
Anodized aluminum body contains all components except motor.







FLOW DIAGRAM



☆ *Write for Aviation Products Catalog 340*

EASTERN INDUSTRIES, INC.
100 SKIFF STREET
HAMDEN 14, CONN.

One source for component parts really pays off...coordinated shipments, the same high quality standards, one responsibility are just a few of the many advantages. H-P-M is the source for a complete line of pumps, power units, valves, cylinders and system accessories. H-P-M's experience background in the design and building of hydraulic systems can be a real help when needed. Write today for a complete catalog. Ask for Bulletin 1101. Make H-P-M your standard for savings.

HYDRAULIC POWER DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.
A DIVISION OF KOEHRING COMPANY

HPM

NFPA

LETTERS to the editor

14-inch Diameter Cylinder

Can you advise a source for an up-acting ram and pot for hydraulic press operating at 3000 psi, in two sizes: 10-inch diameter with 8-10-inch stroke; 14-inch diameter with 10-12-inch stroke.

L. A. NOTHNAGLE, JR.
Nichols Engineering, Inc.
Shelton, Conn.

The Cylinder Guide in this issue will help you find several sources.

Basic Pneumatics

A customer of ours would like 12 copies of your "Beginner's Course in Basic Pneumatics", for a night course of study.

H. HEMMING
Gibson Engineering Company
Boston, Mass.

Copies of this Course are no longer available. If recent issues of APPLIED HYDRAULICS, *or tear sheets of articles, will help, we will be glad to furnish them.*

Testing Fluid Life

We have recently undertaken development of some test equipment to determine expected life of various hydraulic fluids under shear, pressure, and temperature extremes as experienced by a guided missile in flight. Can you give us the name of a manufacturer of fluid breakdown test equipment?

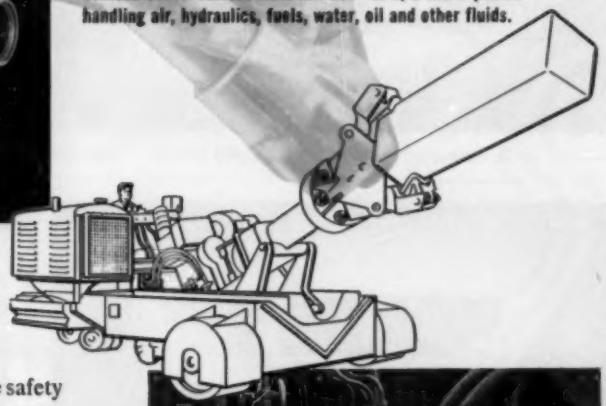
L. D. CARVER
Group Supervisor
Convair Division
General Dynamics Corp.
Pomona, Calif.

At the 1953 *National Conference on Industrial Hydraulics, O. E. Teichmann and W. P. Green of Armour Research Foundation, Illinois Institute of Technology, presented a paper "Friction and Wear Phenomena", giving the results of their investigation with fluids. Their work was sponsored by Wright Air Development Center. We suggest you contact the Conference Secretary, Raymond Meade, Technology Center,* 3300 *S. Federal, Chicago* 16, *Illinois, for information on the equipment used by Green and Teichmann. Also, the technical divisions of the various oil companies may be able to help you.* ▼▼▼

CHIKSAN

Works wonders with hydraulic lines

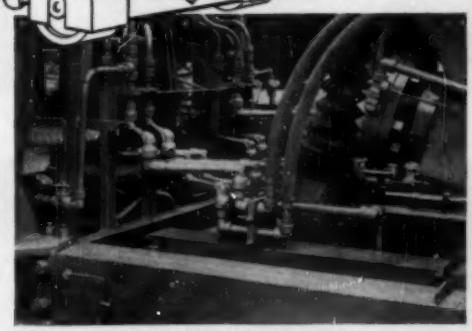
Chiksan Swivel Joints rotate full 360° in 1, 2 and 3 planes handling air, hydraulics, fuels, water, oil and other fluids.



CHIKSAN SWIVEL JOINTS

Give metal lines the flexibility of rubber with the safety and service life of steel. And with free swiveling 360° rotation, Chiksan Swivel Joints eliminate line failure due to bend radii and torsion fatigue.

Investigate Chiksan Swivel Joints for application in your plant and on your products. Their modest cost is quickly repaid in savings of down-time, replacements and maintenance.



Installed on hydraulic lines of a Salem-Brosius forging manipulator, these Chiksan Swivel Joints have been in continual service for over 3 years with no down-time to date.

FOR FREE CATALOG WRITE DEPT. 151

CHIKSAN

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

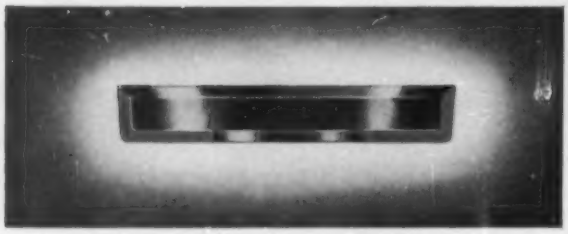
fmc

CHIKSAN COMPANY — BREA, CALIFORNIA • CHICAGO 5, ILLINOIS • NEWARK 2, NEW JERSEY

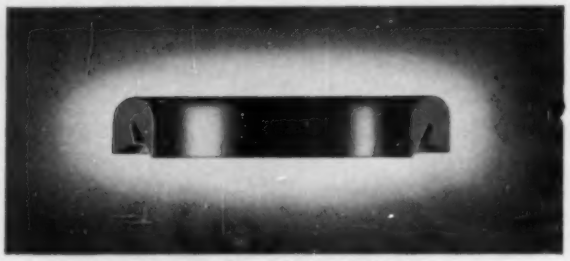
Well Equipment Mfg. Corp. (Division) Houston 1, Texas • Chiksan Export Company • Chiksan of Canada, Ltd., Edmonton, Alta.

Simplify your sealing problems...

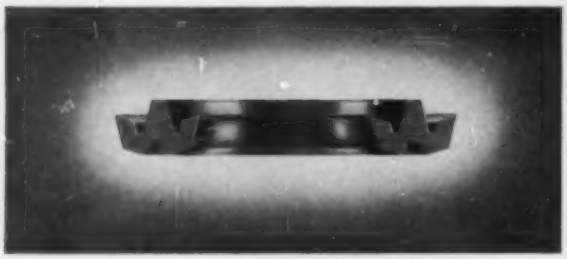
with Johns-Manville Precision moulded packing designs for pressure applications in hydraulic and pneumatic equipment



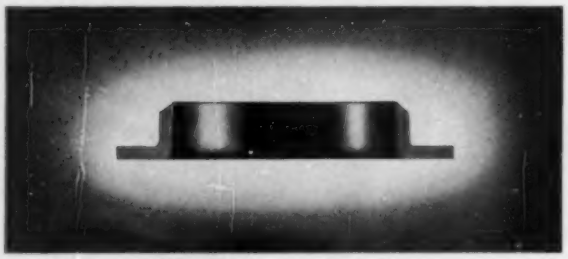
1. Type "A" Packing Cups for pistons
(the original "square heel" cup design)



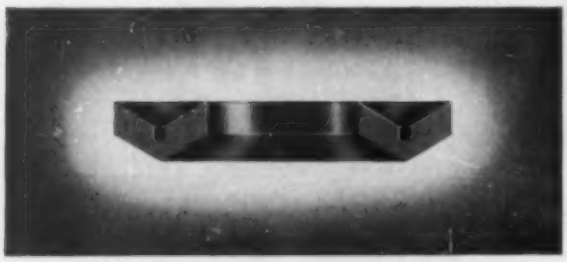
2. Sea Ring packing for rods



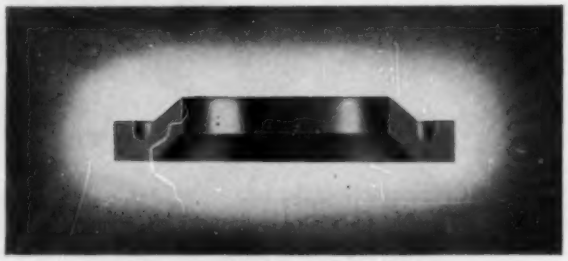
3. Uneepac Packing for rods and pistons



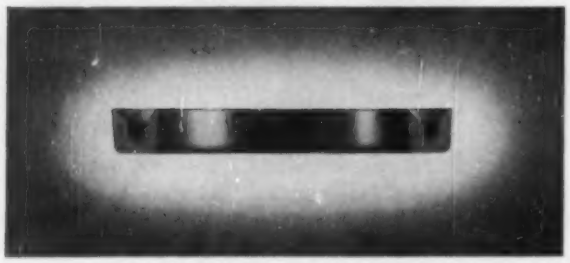
4. Hat Cup Packing for rods



5. V-Rings packing for rods and pistons



6. Cumpac #239 packing for rods



7. U-Cup Packing for rods and pistons

THE WIDE VARIETY of Johns-Manville Packing designs enables you to handle practically any sealing problem. The designs shown on this page are obtainable in a broad range of standard sizes and in materials designed for either usual or special service conditions encountered in hydraulic and pneumatic equipment. Johns-Manville also produces oil seals, moulded gaskets and miscellaneous shapes to specification. See your local J-M distributor or J-M sales office for product or engineering data. Or write Johns-Manville, Box 14, New York 16, N.Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE PRODUCTS

Johns-Manville MOULDED PACKINGS

This ancient wayside cross has stood in the village of Meriden for some 500 years and by tradition marks the centre of England.

THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

Write us for the name and address of your own Keelavite agent.

KEELAVITE
ROTARY PUMPS & MOTORS LTD.
ALLESLEY - COVENTRY - ENGLAND
Tel.: MERIDEN 441 Grams: KEELAVITE COVENTRY

Just one mile from the centre of England, is manufactured the complete range of Keelavite quality hydraulics. Circuit design and equipment installation services engineer these products into Keelavite hydraulic power transmissions renowned throughout World industry for their reliability, performance and economy.

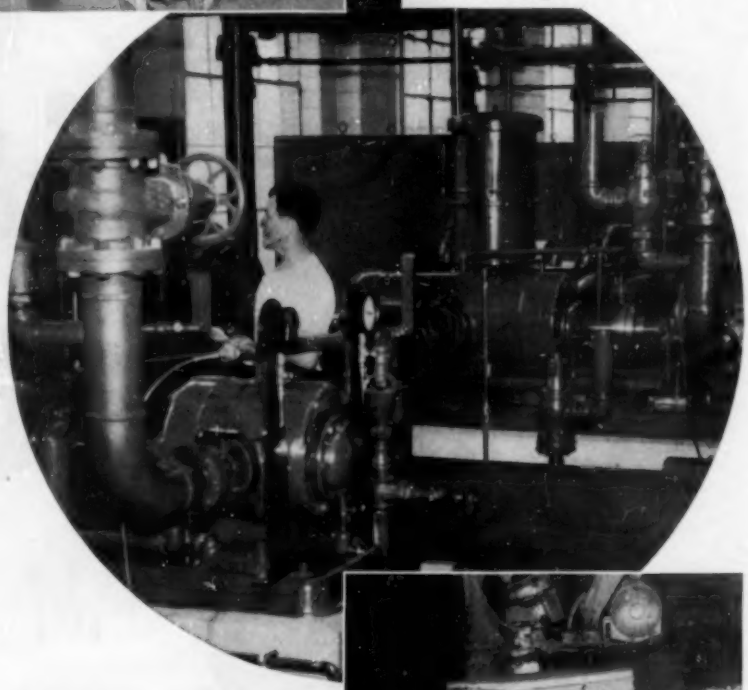
Canadian Agent: JOHN SPOTTON CO., LTD., 21 CARSON ST., TORONTO 14, ONTARIO

VISIT OUR BOOTH 1664
PLANT MAINTENANCE SHOW
CLEVELAND JAN. 28-31

Sand blasting machine, in continuous operation, requires 844 cfm to operate.

Six Fuller Compressors supply a total of 6,800 cfm at 125 psig for plant operations at Textile Machine Works, Reading, Pa.

Molders use compressed air to operate hopper-gates, vibrate sand evenly throughout mold, remove pattern plate, squeeze sand in finish, and clean up.



Compressed air lifts flask off pattern plate for removal by hoist or crane.

Air-Powered Foundry Operations

. . . at Textile Machine Works

Six Fuller Rotary Compressors are supplying air power for the many foundry operations at Textile Machine Works, Reading, Pa., makers of full-fashioned hosiery machinery, machine tools, etc. By utilizing air, Textile Machine Works has successfully mechanized much of its production—thereby biting deep into time consumption and improving product quality.

Fuller Rotaries are vibrationless (perfect for light foundations) and provide pulsation-free air at low cost. The Fuller-pioneered rotary principle requires a minimum of moving parts—insuring high reliability and maintaining capacities for the life of the machine (pressures up to 125 psig; capacities to 3,300 cfm).

Right now in your plant there may be a need for air power. Write for full information about Fuller Rotaries—your best bet for every air-operated device.

FULLER COMPANY GENERAL AMERICAN TRANSPORTATION

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FULLER COMPANY
142 Bridge St., Catasauqua, Pa.
SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION
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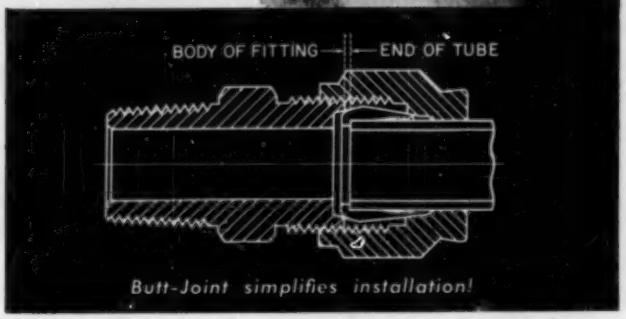
Fuller
. . . pioneers in harnessing AIR

PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930

the most important advance in tube fittings in 20 years!



New IMPERIAL HI-SEAL

T.M.

Furnished in steel and stainless steel

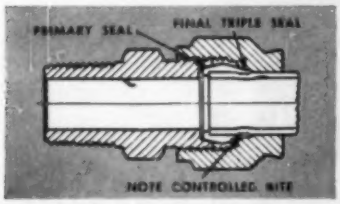
makes a positive butt-joint • no need to spring tubing • withstands higher pressures • foolproof assembly • no flaring or threading

Hi-Seal is the successor to all present tube fittings for high-pressure, severe service. Never before such ease in making a truly foolproof tubing connection. Sleeve fits only *one* way, cannot be installed in reverse — no chance for error. Positive butt-joint with no tube entry into body of fitting eliminates need to spring tubing. This is especially important when working with large-diameter, heavy-wall or hard-temper tubing. Positively no torquing of tube when making a joint!

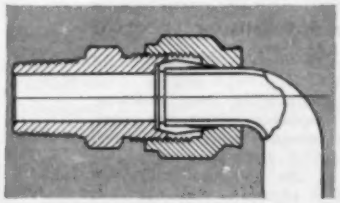
All this plus the fact that Hi-Seal fittings can be disconnected and reconnected as often as desired with assurance of original pressure-tight seal!

Conforms to **J.I.C.** Standards

Ask your Imperial distributor for full details on the Hi-Seal Fitting. Write for Bulletin 3061.



FOOLPROOF ASSEMBLY — Hi-Seal goes together only one way. No need to disassemble or double check for tightness.



CLOSER TUBE BENDS — works in close quarters where other types of fittings cannot be used. A real aid to design.

WITHSTANDS HIGHER PRESSURES — Joints stay tight beyond the burst pressure of the tube . . thoroughly field tested.

Created and manufactured exclusively by . . .

THE IMPERIAL BRASS MANUFACTURING COMPANY

1242 W. HARRISON ST., CHICAGO 7, ILLINOIS

In Canada: 334 Lauder Ave., Toronto, Ontario

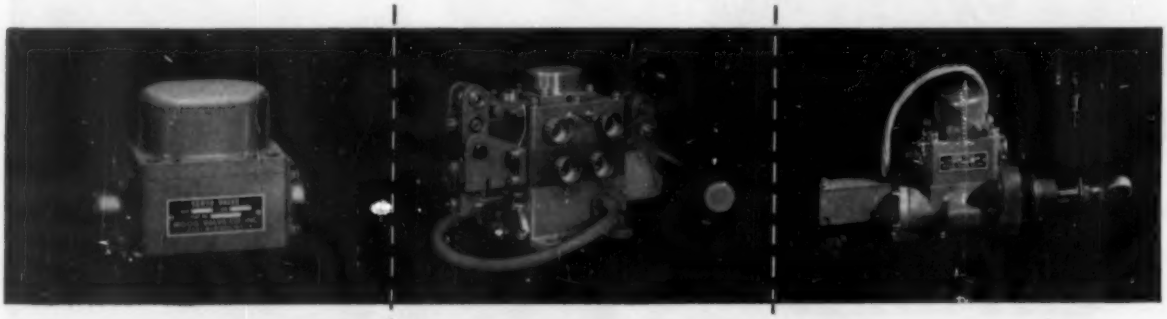
IMPERIAL

Industry's most complete line of tube fittings and tubing tools.

From MOOG . . . **Advanced Electro-Hydraulic Servo Components**

Moog is the industry's leading producer of electro-hydraulic servo valves. This leadership has been achieved by advanced valve design resulting in high performance, high quality, reliability and efficient manufacture. The same creative approach applied to industry's newer problems has resulted in the introduction of Moog Dual Input and Servo Actuator units.

These recent achievements in the creation of advanced custom designed electro-hydraulic servo components are evidence of Moog's continuing progress.



SERVO VALVE

• These proportional "dry motor" electro-hydraulic servo valves feature high dynamic response, sensitivity, linearity and reliability. Light-weight and compact, they are also available in custom designed versions for special or advanced applications.

DUAL INPUT SERVO VALVE

• This new component provides for positioning of aircraft control surfaces by summing mechanical and electrical inputs without external use of mechanical linkages. Use of an entirely new concept offers improved performance, system simplification and saving of space and weight.

SERVO ACTUATOR UNIT

• Custom designed integrated assemblies include actuating cylinder, electro-hydraulic servo valve and feedback sensing device. In a closed loop, actuator displacement is a function of input signal.

TO THE ENGINEER IN A "HURRY"

Axiomatically, to get somewhere in a hurry, you get aboard something that moves pretty fast.

If your "somewhere" is a career in engineering, consider Moog. From three founders to five hundred employees within five years, we are today the industry's leading manufacturer of advanced electro-hydraulic servo components. Our engineers made this possible by continuous pioneering of the new and successful developments in the field. As our rapid expansion continues, we have many openings at all levels for qualified personnel.

Best time to get aboard is now.

MOOG

MOOG VALVE CO., INC. PRONER AIRPORT, EAST AURORA, NEW YORK

Research Laboratory, Paramus, New Jersey

flattening a wrinkle or blasting an invader . . .

LINEAR SILICONE "O" RINGS

MAINTAIN A PERFECT OIL SEAL

under high heat and pressure . . .

The workaday steam iron and the guided operational missile have a common need: Both require seals which withstand *extremes in temperature and pressure.*

In these and many more applications beyond the ordinary thermal range, LINEAR SILICONE "O" RINGS provide the answer. The product of Linear pioneer research, these specially compounded "O" Rings retain flexibility at temperatures as low as —130° F. Yet they also maintain dimensional stability . . . resist compression set at temperatures as high as 500° F.!

Moreover, resistance to moisture, oxidation and mechanical shock make LINEAR SILICONE "O" RINGS an excellent choice in many other modern sealing problems. They are precision molded to your exact specifications. Get the full facts now!

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

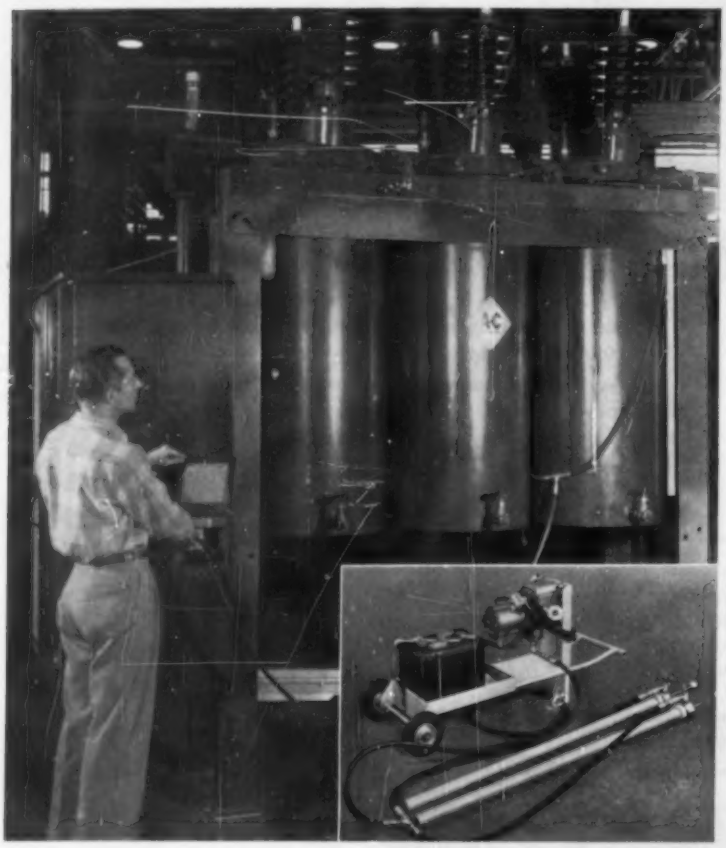
LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.

BRIEFS about fluid power

OIL CIRCUIT BREAKER TANK LIFTER IS HYDRAULICALLY OPERATED

Allis-Chalmers Manufacturing Company has developed this new tank lifter which reduces the time and labor involved in raising and lowering oil-filled tanks of frame-mounted outdoor oil circuit breakers.

The unit consists of two cylinders containing pistons and a length of flexible hose with quick disconnect couplings. It can be operated directly from the "Pneu-Draulic" operator of the breaker or from a portable battery powered pump. When lifter is operated from the breaker, it connects to the breaker's hydraulic system. The raising and lowering of the tanks is controlled by two manually operated needle valves. In raising the tank, pressure is allowed to enter the cylinder by means of a pressure control valve. Tank then rises at a controlled speed to the up position where it is supported by pressure within the cylinders while the tank is bolted. The pressure is then reduced and the cylinders removed. An oil filled tank can be completely raised or lowered within 40 seconds after the operation has been initiated. The accumulator of the "Pneu-Draulic" operator contains enough energy at normal operating pressure to raise and lower all three of the breaker's tanks without needing recharging.



Illustrations show the tank lifter powered off the "Pneu-Draulic" operator of the breaker and (inset) the portable battery operated hydraulic unit, designed for use with solenoid and pneumatic operated intermediate capacity outdoor oil circuit breakers. Total weight of the entire portable unit is 85 pounds. ▼▼▼

Metal Powder Press Uses Air And Oil Power

• **Greater Flexibility**—A new hydraulically operated press, developed by Baldwin-Lima-Hamilton Corp., will enable fabricators to extend the range of part sizes and shapes to be compacted without additional tooling.

• **Fluid Powered** —Two previous presses developed for compact-

Continued on page 32

OUR IDEA WAS TO BUILD A BETTER VALVE...
MECHANICAL AIR CONTROLS, INC.
10030 Capitol, Oak Park, Detroit 37, Michigan
MAC
AND THE VALVE SEAL IS
sirvene

WHEN YOU DEMAND CRITICAL PRECISION

Only one part . . . the spool . . . moves in this ingenious MAC 4-way air valve. It's an oscillation that must be critically precise . . . and is. The C/R Sirvene (synthetic rubber) parts seal the valve circuits under pressures up to 150 psi and over a wide range of temperatures and cycle speeds. To operate correctly, those small Sirvene parts must be molded to unusually close dimensional tolerances. C/R is consistently meeting...and beating these tolerances. And MAC reports that on the toughest jobs their valves have run for millions of cycles without trouble.

You can have the same dependability. Whenever your mechanism design demands the most exacting qualities in a molded pliable part . . . depend on Sirvene. As a start—write for your copy of the new "Sirvene" booklet.

SIRVENE C/R DIVISION
CHICAGO RAWHIDE

CHICAGO RAWHIDE MANUFACTURING COMPANY
1203 Elston Avenue • Chicago 22, Illinois

Offices in 55 principal cities. See your telephone book.

In Canada: Manufactured and Distributed by Chicago Rawhide Mfg. Co. of Canada, Ltd., Hamilton, Ontario

Export Sales: Geon International Corp., Great Neck, New York

Other C/R Products
C/R Shaft and End Face Seals • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears

HOUGHTON . . .
Headquarters for Hydraulics

ONE SOURCE for
to get the full potential

Choose hydraulic packings and fluids that work together —

Select them from *one proven source;* then you know they will be compatible; no divided responsibility. And they will give new life to the systems you design.

Packings should do more for you than just seal pressure. In fact, unless the packings you choose are as modern and well-engineered as the system itself, you're going to be short-changed on wear and performance.

Fluids, too, ought to do more than just transmit energy. Today's fluids should be able to satisfy any demands you make on them, ranging from fire-safety to their chemical and physical ability to hold up over long periods.

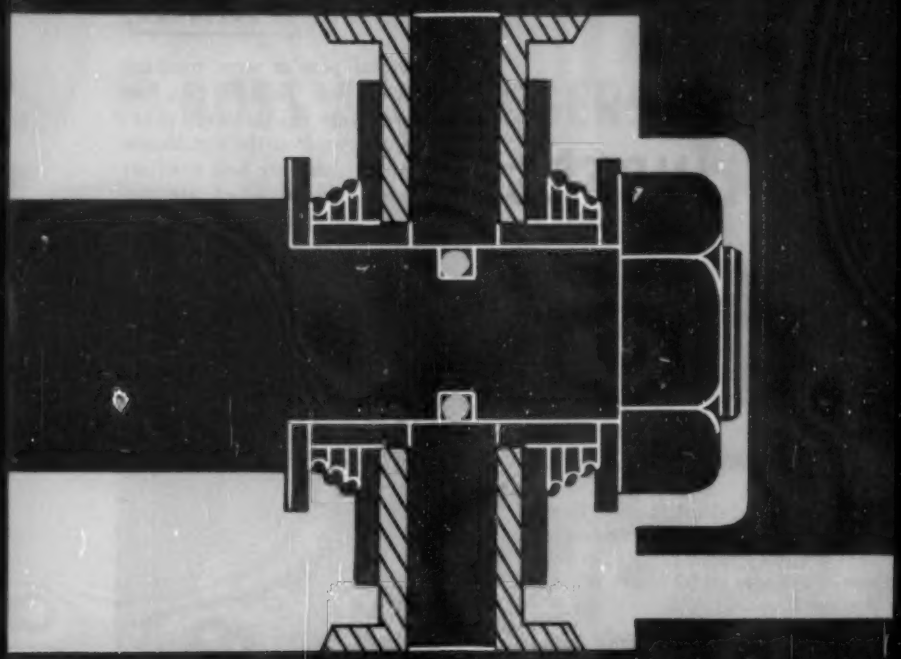
These Houghton packings and fluids illustrate the kind of "Extras" you need to give you *full* performance from every system you design:

1243-3 Rubber-Impregnated Leather Cups. Resilient as rubber, but with leather's tough wear-power and anti-extrusion qualities. These packings have opened new fields for designers.

VIX-SYN Fabricated Synthetic Rubber Packings. These new packings are setting records for wear. In tests, cup packings have withstood as many as 28,000 wearing cycles at 4,000 psi without signs of failure.

VIX-SYN Homogeneous Synthetic Rubber . . . "U" cups, "V"s and "O" rings . . . you'll find the same kind of advanced thinking reflected in the many special compounds available for varying service conditions and fluids.

Houghto-Safe 620. A non-petroleum, aqueous base hydraulic fluid which provides maximum fire resistance. In addition to complete fire safety, it helps packings give superior service because it is chemically inert to all standard packing materials. Its



Spring Loaded
Cup Packings . . .
A HOUGHTON "First"

Packings and Fluids
of your design . . .

lubricity and film strength prolong pump and equipment life. Use it in over 80 percent of all hydraulic applications.

Houghto-Safe 1020. Where systems demand higher lubricating qualities along with fire-resistance, this new Houghton fortified phosphate ester type fluid is your best bet.

Hydro-Drive. In systems where petroleum fluids are safe, Hydro-Drive offers all the advantages of pure, high-quality oil plus chemically-increased film strength, lengthened service life, and fortified gum-dissolving, rust-preventing power.

Hydrolubric. As an additive for water-operated hydraulic systems, Hydrolubric very nearly makes oil out of water. It prevents rust, keeps evaporation to a minimum, and delivers positive, reliable lubrication to all working parts.

You get another assist from Houghton in packing engineering. Square shoulder cups and the wear-saving spring mount for cup packings are Houghton developments. Standard stack heights for "V" Packings is another innovation that lets you use any one of three kinds of packings in the same gland.

Write — or make sure to ask the Houghton Man when he calls at your plant — for full information on all the new Houghton developments for Hydraulic and Pneumatic equipment.

. . . products of

E. F. HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

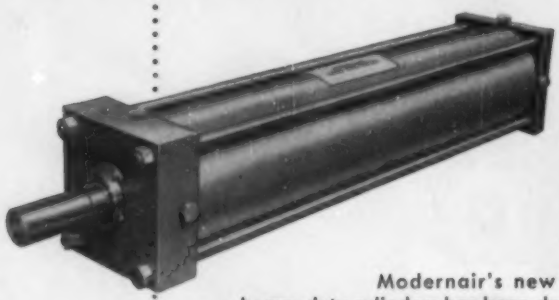
Ready to give you on-the-job service . . .

Circle 90 on Reader Service Card

NEW

Modernair

HEAVY DUTY CYLINDERS



Modernair's new line of heavy-duty cylinders has been developed to meet the need for a rugged, reliable, long-lived cylinder under heavy mill-type service conditions.

They are offered in two types: the series HA for air service up to 200 psi; the series HH for hydraulic service up to 1000 psi. Both types are available in 3¼", 4", 5" and 6" bore sizes, stroke length optional.

CONSTRUCTION FEATURES

Rolled steel cylinder heads

Extra-heavy tie rod construction

Heat-treated, chrome-plated piston rod resists wear and corrosion

Self-adjusting, wear-compensating "Uneepac" seals on rod packing

Cartridge-type rod packing and gland seal assembly for easy servicing

High tensile aluminum alloy piston head, specially treated for corrosion and wear resistance

Needle-valve cushion adjustment — floating high durometer Hycar "O" ring type cushions on HA cylinders, tapered cushion bosses on HH cylinders

Modernair "ruggedized" cylinders and control valves can cut your maintenance expenses and downtime losses to the bone. Why not get the facts now? Write for catalog, specifications and prices... please address Dept. BI.

Modernair CORPORATION

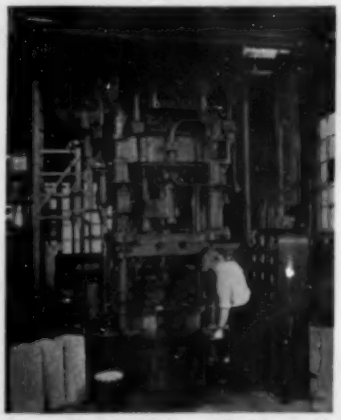
400 PREDA STREET
SAN LEANDRO, CALIFORNIA

28

MEMBER OF NATIONAL FLUID POWER ASSOCIATION

BRIEFS continued

ing metal powder were mechanically operated. This 300 ton, four column press has the main platen moving down from the top. Mounted on the platen are four auxiliary cylinders, two of which are connected to an inner top punch platen and two to an outer top punch platen. The main platen exerts a



force of 300 tons, and the auxiliary cylinders can be adjusted up to a maximum pressure of 125 tons. The die platen, held in its top position by two air cylinders, is equipped with 300 ton adjustable stops to limit its downward movement. The bottom or ejector platen, is operated hydraulically with a maximum force of 300 tons. ▼▼▼

Hydraulics Fires Gun

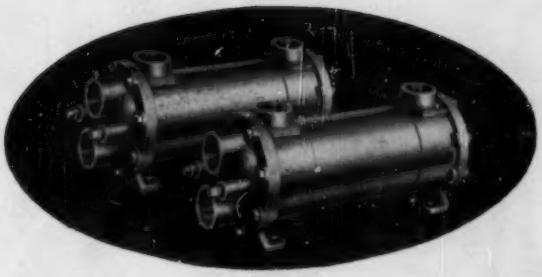
• **Increased Firing Speed**—A new rapid-firing 20 mm weapon, one of the first specifically designed for supersonic jet aircraft has been developed by General Electric's Aeronautic and Ordnance department with assistance from the Armour Research Foundation of Illinois Institute of Technology. The new gun is externally powered by either electricity or hydraulic fluid. Simple to operate and maintain, the new weapon—named Vulcan—can be field stripped and reassembled in less than 30 minutes. The unit is capable of firing at an extraordinary high rate in the short time available to shoot at fast moving targets. ▼▼▼

Continued on page 34

Circle 124 on Reader Service Card

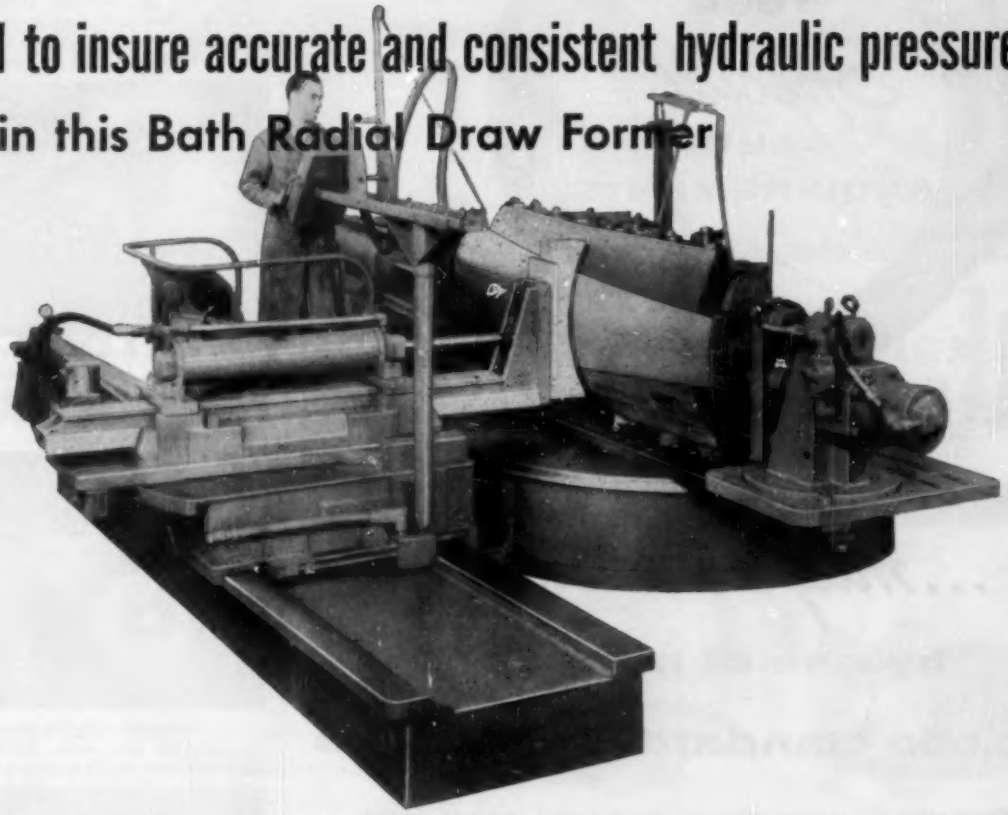
Circle 38

ROSS EXCHANGERS



"used to insure accurate and consistent hydraulic pressures"

in this Bath Radial Draw Former



Turning out contoured parts for jet aircraft and missiles, this Bath Type CF-25 Radial Draw Former combines two hydraulic systems in a unique *stretch* and *squeeze* process. Aluminum, stainless steel, titanium and other ductile metals are stretched to yield point, then bent around a die by an unusual *ironing* method.

Providing safe, dependable cooling of the oil for the hydraulic stretch ram and compression ram are two Ross Exchangers. Carefully controlled temperatures maintain oil viscosity, thereby insuring rated hydraulic power for these exacting stretch and compression operations.

"Ross Exchangers", states the Cyril Bath Co., "are used to insure accuracy and consistency in hydraulic pressures as well as protect the hydraulic system from the damages that occur with over-heating. In many years of using Ross Exchangers, we have found them completely effective and trouble free in operation."

Widely specified for numerous other types and makes of hydraulic machinery, Ross Exchangers are pre-engineered, fully standardized and available in a wide range of sizes to fit your needs.

Learn more about these rugged, non-ferrous units that are unequaled in thermal efficiency. Write for Bulletin 1.1K5. Ross Heat Exchanger Division of American-Standard, Buffalo 5, N.Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

ROSS

ROSS HEAT EXCHANGER PRODUCTS

...may be answered

by one of more than

50,000 standard USG gauges

Eliminating the expense of special gauge design and manufacture is an important factor in reducing production costs. To keep costs low on "special" gauge designs, USG is tooled for more than 50,000 different standard gauges. Many of these are of unique design and application. It is possible that with slight modification one or more of them will exactly meet your design requirements and save you important time and costs.

The U. S. Gauge background of over 50 years of gauge design and manufacture assures you the experience and resources that make possible an easy solution to special gauge applications.

Why not call the nearest USG Distributor or write the factory direct to determine whether we can supply a standard to your specifications, a modified standard, or whether or not your problem will actually require a completely new and special USG design. The call might save you hours in production time and a significant savings in cost.

USG UNITED STATES GAUGE

Division of American Machine and Metals, Inc.
Sellersville, Pa.

Home of the SUPERGAUGE

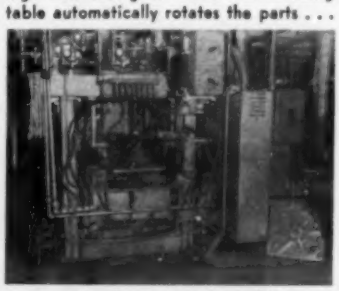
BRIEFS / continued

Fluid Power Replaces Manual Operation

In order to increase production of automatic washing machines, plant engineers of Whirlpool-Seeger Corporation developed fluid powered machines to help in the manufacture of parts.

Here is a press designed to install bushings, burnish a face and dispense the correct amount of grease. Sequencing of operation is by limit switches and pneumatic timer . . .

. . . hydraulic cylinders press bushings into the gear cases. An indexing table automatically rotates the parts . . .



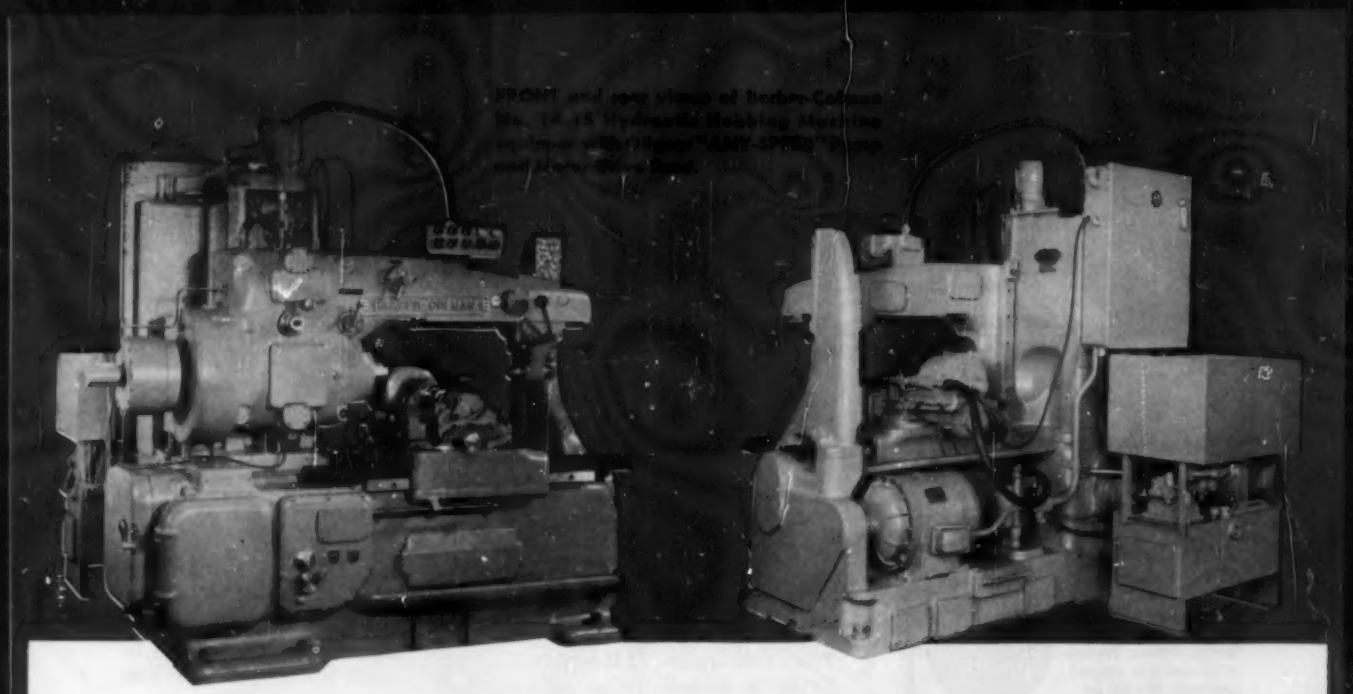
. . . pins for automatic washing machine parts are inserted in this pneumatically operated hot upset machine.

▼▼▼

FCI Fall Meeting

The Fluid Control Institute, Inc. held its Fall Meeting at the Edgewater Beach Hotel in Chicago, October 25-26. Topics covered included "Manufacturer's Agents vs

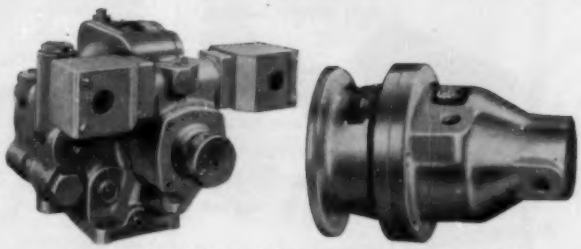
Continued on page 36



ANOTHER TRIUMPH IN MACHINE DESIGN THAT USES OILGEAR "ANY-SPEED" DRIVE FEEDS

Barber-Colman's new high-speed hobbing machine may be totally different from the machines you build. But the machine design problems they encountered in developing this machine could very well be your problems. Among the problems encountered was that of feed. To solve this problem, Barber-Colman selected Oilgear Fluid Power Feeds. These feeds give them the infinitely variable output to provide a hobbing feed range of .020" to 1" per minute. In addition, they provide a far more constant hobbing feed despite changes in load or system temperatures. They also provide cushioned, positive, precise, fast-acting electro-hydraulic control of feed, rapid traverse, and stop through automatic switches. Finally, they provide power for operating ten auxiliary cylinders and three valves. One Oilgear type AX-311 Pump supplies fluid power for the entire machine.

You have much to gain if you stop a moment and ask: "Why are leading machine and machine tool builders turning to Oilgear? Am *I* missing an opportunity to improve machine performance?" Why don't you compare your machine needs with what Oilgear "ANY-SPEED" Drives and Feeds can provide? You can rest assured that we will recommend our product only when it is to your advantage. Tell us your needs. We'll give you a specific appraisal of the possibilities. Write now. THE OILGEAR COMPANY, 1564 W. Pierce Street, Milwaukee 4, Wisconsin.



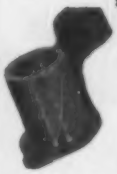
Type AX-311 PUMP and Type H-311 MOTOR
OILGEAR "ANY-SPEED" DRIVE FEED

OILGEAR
Fluid Power

PIONEERS... NOW THREE PLANTS FOR FLUID POWER

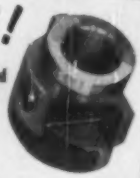
PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS & VALVES

INVESTIGATE!



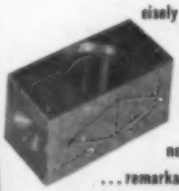
It's just good business to specify Promet Engineered Bronze Bearings, Bushings and Wearing Parts. For proof send prints and condition of operation for recommendations and quotations.

SPECIFY!



Superior service guaranteed or your money back! Special formulas, developed for specific or unusual conditions. Will not cut or stick to the shaft under ordinary operating conditions. Carry on during temporary lubrication failures. Absolutely will not powder in severest service.

SAVE!



Highest quality machining to precisely controlled tolerances. Difficult oil grooving . . . smooth groves, even around acute bends . . . no sharp edges or burrs . . . remarkably better lubrication. Also available rough cast.

SEND PRINTS and condition of operation for recommendations, quotations, literature and service data sheets.

The American Crucible PRODUCTS CO.

"Bearing Specialists Since 1919"

1303 OBERLIN AVENUE, LORAIN, OHIO, U.S.A.

Please send free literature and service data sheets on Promet Bronze.

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Circle 13 on Reader Service Card

BRIEFS continued

Direct Sales Office" and "Automation—New Tool in Sales Management". Institute membership consists of manufacturers of valves, heating specialties, traps and steam heating pumps. President of FCI is John Koch of Conoflow Corp. ▼▼▼

Contour Machining Conference

Success of last year's Contour Machining Conference led True-Trace Corporation, El Monte, California, to sponsor the second annual conference at the end of October. George F. Fry, Jr., president of True-Trace, noted that the lack of information on contour and profile machining methods in the aircraft industry, could be best overcome by the presentation and discussion of problems and their solutions relating to this subject.

George F. Fry, Jr.

Continued on page 38

A hydraulic backhoe has been designed and built by Sherman Products, Inc., for attachment to Fordson-Major tractors. Twin crow cylinders for extra balanced power permitting fast, efficient digging, are a new feature. Steel cable linkage between two opposing long-stroke, double-acting hydraulic cylinders provides smooth, positive control of swing action. Cylinders have been newly designed. The unit also features an independent hydraulic stabilizer.

IN AIR CYLINDER OPERATION BELLOWS GIVES..

ALL THE ADVANTAGES OF INTEGRAL VALVING WITH EITHER 8 or 115 VOLT BUILT-IN CONTROLS

The Bellows Air Motor with the built-in 8-volt directional valve revolutionized the use of pneumatic circuits. Here for the first time was an air cylinder with directional valve, speed control valves, and electrical actuators built-in . . . to form one compact, streamlined power unit—offering instant action, positive control.

That same positive control is also available with built-in 115-volt directional valve control. The 115-volt unit offers all the advantages of compact design, instant action, proven so popular in the 8-volt unit.

Here is air cylinder power at its best—air cylinder power free of bulky power solenoids, of cumbersome piping, of complex circuitry—air cylinder power that goes hand in glove with today's streamlined design.

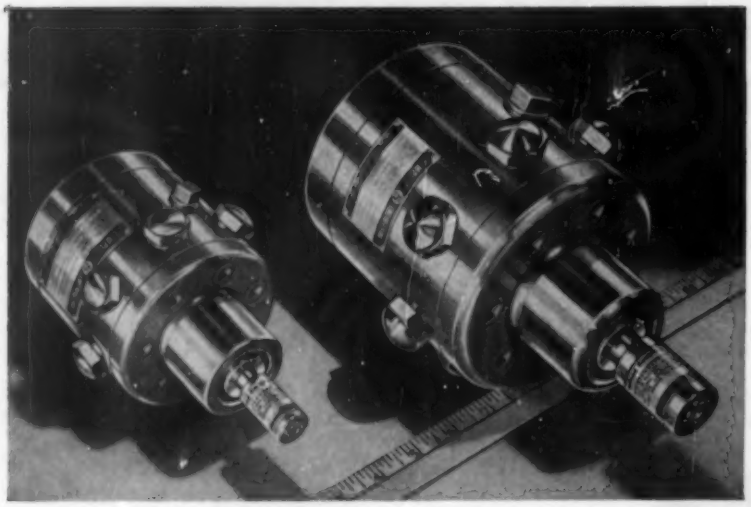
WRITE FOR THESE TWO BOOKLETS

Fifty pages of data to help you select the right air motor-valve combination for your job. Address: The Bellows Co., Akron 9, Ohio (Dept. AH-157).

In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

The Bellows Co.
AKRON 9, OHIO

7348



designed for 10,000 PSI

—same high efficiency at LOW pressures

SECO radial hydraulic pumps generate pressure *within hollow pistons*. Due to the inherent sealing quality of this design, these pumps develop pressures up to 10,000 PSI without loss of mechanical efficiency.

The LA Series SECO pumps (illustrated) have proved ideal for generating that final "big squeeze" in many high-low operations.

And for applications where no large fluid volume is required, but where higher working pressure would *reduce the bulk of all components*, these pumps open new horizons in the design of oil hydraulic systems.

If, however, your current interest is in pressures only up to the commonly accepted 5,000 PSI range, consider this: At such pressures SECO pumps merely loaf, so far as *stress* and *wear* are concerned. Even at their highest rated capacities SECO pumps rarely require any servicing.

SECO Series LA pumps are made in 5 models, delivering from ½ GPM to 5 GPM, and developing pressures of 500 to 10,000 PSI. Other models are available in greater capacities and higher horsepower.

Whether your interest is in higher pressures, or simply in longer pump life and freedom from servicing—you should be familiar with these pumps. For complete information use the Reader's Service Card.

SECO

SERIES LA "HOLLOW PISTON" PUMPS

SIMPLEX ENGINEERING CO.
ZANESVILLE, OHIO

BRIEFS continued

Among the papers presented were Unique Tracer Applications for Tooling and Production, by R. W. Peters, chief tool engineer, Convair, Air General Dynamics; Contouring Equipment Progress at NAA, by Charles Morlath, North American Aviation, Inc.; and Use of Tracer Controls in Job Shop Production, by James Dillon, president, Darco Industries, Inc.

In association with a representative group in the Airframe industry, the company produced a motion picture especially for the conference, which graphically showed the advances in contour machining applications during 1956. ▼▼▼

Four year scholarships to the University of Tennessee valued at $2200 each, are being offered to three outstanding high school graduates by the Fulton Sylphon Division of Robertshaw-Fulton Controls Company. The company, in making the scholarships available, wishes to encourage students to enter the field of mechanical or electrical engineering. Illustration shows—from left to right—Dr. C. E. Brehm, president of University of Tennessee, Freeman G. Cross and Chauncey N. Mynderse, vice presidents of Robertshaw-Fulton at the scholarship inauguration.

Seal Design For Air Brake Valves

• **Premature Valve Failures**—This long existing problem had to be faced by manufacturers of air brakes for trucks because deposits of sludge and carbon built up around seals within the valves. Such matter is composed of minute particles of lubrication oil in the compressor section which are forced through the compressor in-

Continued on page 40

it gives—
and it takes

the higher the pressure—
the better the seal

NOTHING
GETS PAST

Hallprene

Hallprene

the seals that pressure can't lick

HALL &
HALL LTD

P4309

Moisture Can Mean Trouble

In compressed air lines, moisture is a menace. Eliminating oil and moisture with Heat-X aftercoolers and moisture separators provides low cost insurance against receiver tank explosions, rusting and corroding of pipe lines, fouling of air instruments and freezing of water in pipelines and air tools. Units are easily installed on existing systems.

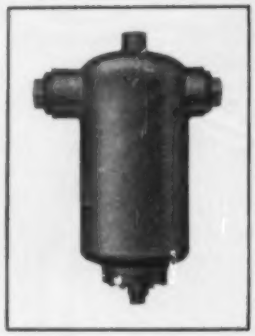
'WIA' AFTERCOOLERS

Cover the range from 100 to 1,000 C.F.M. Longitudinal Inner-Fin construction, *exclusive with Heat-X*, provides maximum heat transfer with minimum air side pressure drop . . . permits use of a more compact model. Units cool compressed air to within 10° F of temperature of available cooling water . . . use minimum amount of water.

heat-x

'RIA' REFRIGERATED AFTERCOOLERS

For use on systems where extremely dry air is required. Flooded refrigerant side operation, air flow through patented Inner-Fins, makes possible an extremely compact unit. Short length of tubings means low air side pressure drop and a rugged unit with no floating tube sheet. All copper and brass for corrosion resistance and long life. All welded construction.



MOISTURE SEPARATORS

These simple, rugged units separate water and oil that condenses in aftercooler . . . prevent passage of foreign particles into system. Available in capacities from 150 C.F.M. to 1,000 C.F.M.

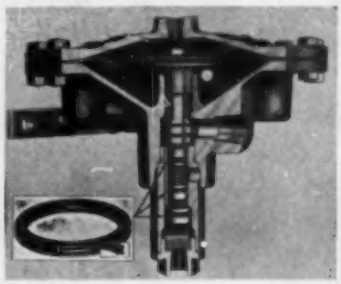
Bulletins containing complete specifications FREE on request

HEAT-X, Inc.

BREWSTER • NEW YORK

BRIEFS continued

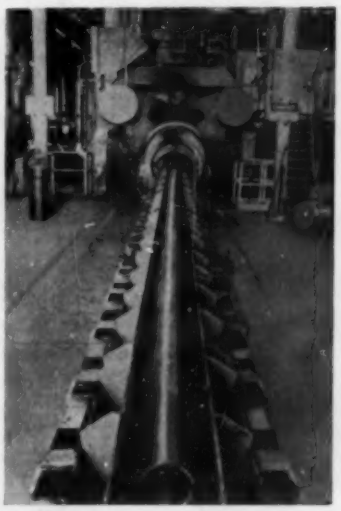
to the tank and lines of the system. When heated and compressed this matter breaks down into pure carbon which solidifies when the truck is left idle and permitted to cool. It should be noted that this process takes many hours of repeated operation of the valve, with



corresponding compression and heat, to reduce these particles to carbon. It does happen eventually, however, and failures result.

• **Testing Different Seals**— Several months ago, Homer T. Seale, Inc., tested in its own laboratories Quad Ring seals in their #1000 relay emergency valve. Al-

Continued on page 44

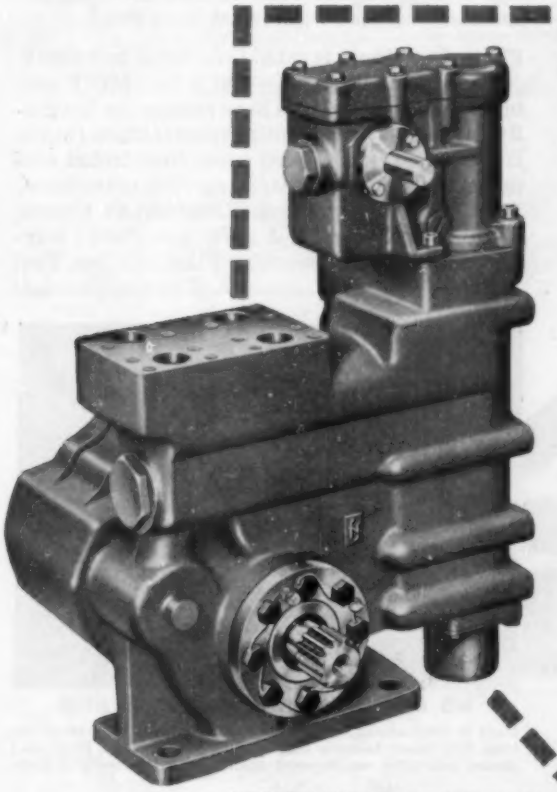


THIS GIANT HYDRAULIC horizontal extrusion press has a 12,000 ton "squeeze" and is 126 feet long. Designed by Loewy-Hydropress engineers, press can extrude a 6-inch diameter, 50 foot tube in 9 seconds. 1,000 feet of ½-inch spring steel rod can be extruded in 3 seconds. Machine produces critical aircraft components from titanium and cladded stainless steel.

CUSTOM DESIGNED
FLUID POWER SYSTEMS
Start with HYDRECO®

THE PROBLEM • • •

To provide a hydraulic system for complete control of a large bulldozer affording sensitive and positive operation of the blade. The system must be extremely rugged, of minimum weight, capable of handling upwards of 160 hp and compacted into definite space limitations.



HYDRECO Fluid Power Unit combination for International Model TD-24 Bulldozer. Rated 160 gpm at 1600 rpm — 1475 psi.

THE SOLUTION • • •

HYDRECO engineers, drawing upon years of experience in solving Mobile Equipment problems, CUSTOM DESIGNED the unit shown at the left. Here, in a single assembly incorporating Pump, Control and Auxiliary Valves, HYDRECO engineers effect an answer which precisely meets all of the requirements for the International Harvester TD-24 Dozer . . . RUGGEDNESS . . . COMPACTNESS . . . WEIGHT ECONOMY . . . PERFORMANCE AND PRICE.

The ability to CUSTOM DESIGN for the specific need can be a highly advantageous facility for YOU. CUSTOM DESIGNING serves to complement the complete line of HYDRECO Fluid Power Pumps, Motors, Valves and Cylinders which are "standard" for so many famous names in Mobile Equipment.

Your inquiry on specific design problems is a challenge the HYDRECO engineer likes to see.

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KALAMAZOO DIVISION
THE NEW YORK AIR BRAKE COMPANY
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Circle 130 on Reader Service Card

Heat resistant and corrosion-proof, too!

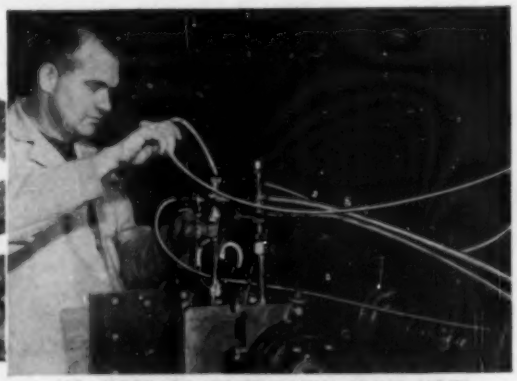
Fluoroflex®-T (Teflon®) Hose Assemblies stand up in severe service

Here is lightweight hose you can rely on where temperature and corrosive conditions are so severe you can't use ordinary hose.

With *patented* tube of Teflon, stainless steel wire braid, and blowoff-proof fittings, Fluoroflex-T hose is ideally suited for use with hydraulic fluids, fuels, oils, steam; for conveying strongest chemical solutions, hot solvents, industrial finishes . . . or what have you?

Fluoroflex-T hose is rated for —65°F to +450°F continuous operation (—100°F to +500°F ambient). Non aging, this hose retains its flexibility indefinitely over entire temperature range. It is the *original* Teflon hose, time-tested and proved by over 4 years' service experience. Send for Bulletin FH-2. RESISTOFLEX CORPORATION, Roseland, N. J.; Western Plant: Burbank, Calif.; Southwestern Plant: Dallas, Tex.

® Fluoroflex is a Resistoflex trademark. Teflon is a DuPont trademark.



NO MORE CONTAMINATION FROM HOSE

Used on hydraulic equipment tester, Fluoroflex-T hose assemblies keep fluid clean because they don't erode. Previous lines used caused excessive replacement costs due to oil contamination.

20th year of service to industry

Resistoflex

Fluoroflex-T hose and assemblies distributed by:

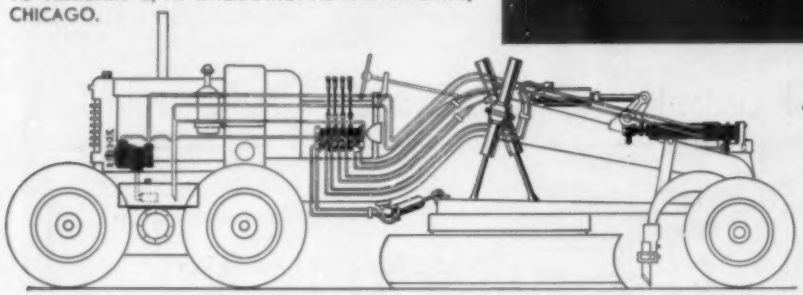
Baltimore, Md. — Briggs Rubber Products Co.
Buffalo, N. Y. — Buffalo Rubber & Supply Co., Inc.
Cambridge, Mass. — Greene Rubber Co.
Chicago, Ill. — Dearborn Rubber Corp.
Cleveland, Ohio — Koehler Rubber & Supply Co.
Dayton, Ohio — Sterling Rubber Products Co.
Detroit, Mich. — F. B. Wright Co.
Houston, Texas — Lone Star Rubber & Specialty Co.
Kansas City, Mo. — Mid-States Supply Co.
Newark, N. J. — Goodyear Rubber Products Corp.
Philadelphia, Pa. — Briggs Rubber Products Co.
Pittsburgh, Pa. — Shields Rubber Corporation
Rochester, N. Y. — Chamberlin Rubber Co.
St. Louis, Mo. — General Equipment Co.
Toronto, Canada — H. J. Miller Enterprises Ltd.
Wilmington, Del. — Briggs Rubber Products Co.

"Nobody puts a fine painting in a dime-store frame." When you see a piece of construction equipment with Vickers Hydraulics, you know it is a "quality" machine throughout.

Vickers provides all the inherent advantages of hydraulics and MUCH MORE: (1) the benefits of a nation-wide and full-time field engineering and service organization of unequalled experience; (2) a complete line of equipment enables Vickers to take UNDIVIDED system responsibility thus eliminating any risk of incompatibility of hydraulic components; (3) a hydraulics school for free training of customers' maintenance personnel.

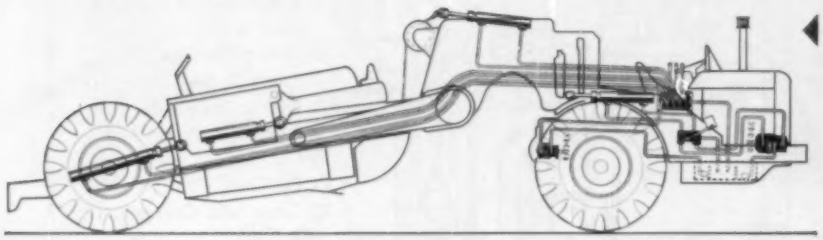
SEE VICKERS HYDRAULICS IN SIMULATED ACTION IN BOOTH 219 AT THE ROAD SHOW, JANUARY 28 TO FEBRUARY 2, AT INTERNATIONAL AMPHITHEATRE, CHICAGO.

VICKERS HYDRAULICS *means* "QUALITY" CONSTRUCTION EQUIPMENT



Motor grader uses Vickers Hydraulics for:
- maximum blade utility
- accurate and effortless tool adjustment
- positioning scarifier
- convenience of control to operator

Hydraulic motor (not shown) rotates blade on circle. Hydraulic power steering is separate circuit. Central hydraulic system is applicable.

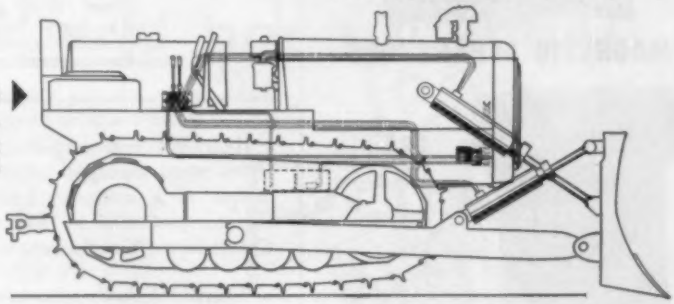


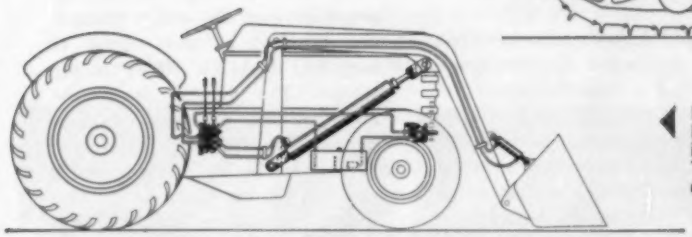
Scraper has VARIABLE rate hydraulic power steering provided by:
- Vickers Double Vane Pump
- Vickers Metering Control Valve
- Vickers Circuit-Splitting Unloading System
- Vickers Overload Relief Protection

Vickers Single Vane Pump supplies power for:
- Fast actuation of bowl
- Fast apron manipulation
- Fast—Positive ejector action

More Work—Less Time—Minimum Maintenance.

Vickers Hydraulics provides fast lifting and angling of bulldozer blade along with exclusive "feathering" ability. Additional tractor attachments added later can be hydraulically controlled by simply adding sections to existing control valve thus eliminating necessity of mounting separate valves.





Fast, easy and dependable operation of front end loader utilizes Vickers Balanced Vane Pump (with inherent automatic wear compensation) and Vickers Two-Section Directional Control Valve. Note simplicity of installation.

SEE VICKERS BOOTH 219
A. R. B. A. ROAD SHOW • JAN. 28-FEB. 2
INTERNATIONAL AMPHITHEATRE, CHICAGO

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
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7695

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

BEWARE OF RUST

in Hydraulic Systems

"It takes only one or two flakes of rust passing through precision pumps and valves to scratch surfaces enough to reduce the efficiency of these components. A scratch on a pump piston can cause an excessive amount of slippage resulting in horsepower loss and overheating. . . ."

Reprinted from Applied Hydraulics April 1956—page 74

Filter Out Ferrous Grit with

FERRO FILTER

MAGNETIC SEPARATORS

High pressure models also available

Get rid of iron particles circulating in fluid power lines and you'll reduce maintenance costs, parts replacement and downtime.

Send for BULLETIN PM-65

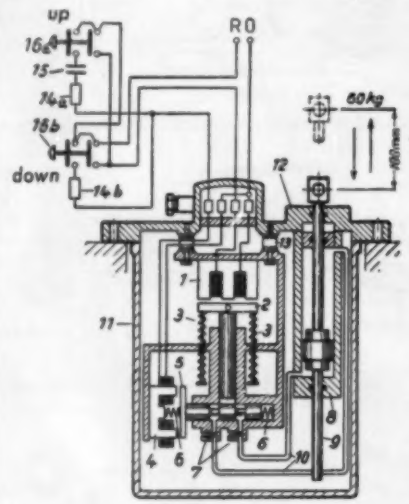
S. G. FRANTZ CO., Inc.

Brunswick Pike & Kline Ave.
P. O. Box 1138 Trenton 6, N. J.

BRIEFS continued

though tested primarily for their sealing properties, the double-lipped packings also displayed an extra facility; while one lip of the packing performed the standard sealing functions, the other acted as a scraper or wiper, keeping the sludge away from the seal. A close and accurate check made on trucks which had these Quad Ring-equipped valves indicated that there was a marked reduction of failures resulting in time and money savings. Pressures in the air brake system were standard at 100-120 psi maximum. ▼▼▼

Electro-Magnet Powers Hydraulic Actuator



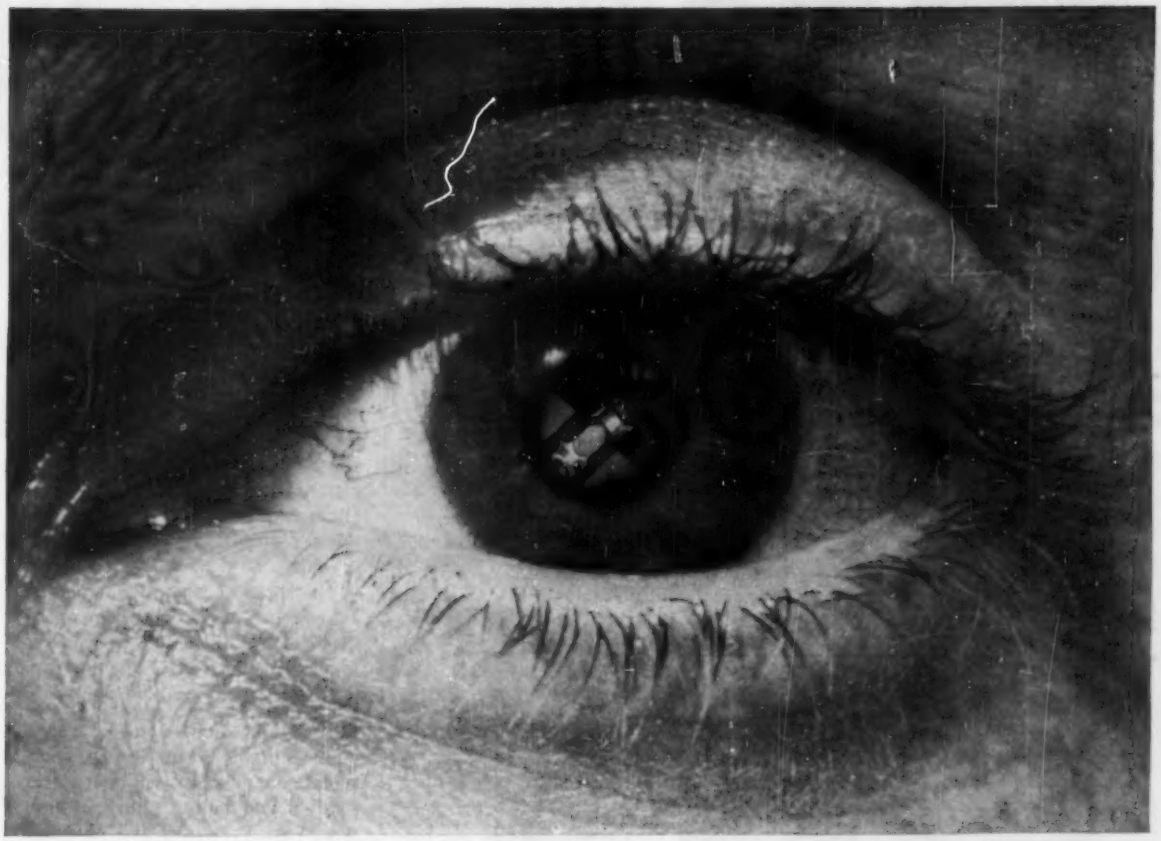
1 Power Magnet
2 Armature with pump piston
3 Pump Springs
4 Control Magnet
5 Armature with two-port Slide Valve
6 Control Springs
7 Check Valve
8 Hydraulic Cylinder
9 Piston with Piston Rod
10 Oil Pipe
11 Oil Tank
12 Cover with Connection Box
13 Vibration Damping Buffer
14 Resistors
15 Capacitor
16 Switch Buttons

Hydraulic and magnetic principles were incorporated in the design of a magnetic hydraulic actuator produced by Allgemeine Elektricitäts—Gesellschaft.

• **Simple Construction**—This device, designated Hydromagnet, consists of a high-frequency reciprocating plunger type pump operating in conjunction with a high-frequency reciprocating control valve connected to a double acting cylinder. The whole assembly is contained within a casing which also serves as the oil reservoir.

• **Operation**—The power for the hydraulic pump is provided by a magnet which is connected to alternating current of 220 volts, with a frequency of 50 cycles per second. In proximity of this magnet is its armature which is suspended between springs and it is this armature which carries the piston of the hydraulic pump. The effect of this design is that the armature and the pump plunger are attracted by the magnet at each half cycle, i.e. 100 times per second. The magnet draws the armature and plunger upwards, drawing oil in through the intake valve at the bottom of the cylinder and for the power stroke the two springs draw the piston downwards, expelling oil to the actuator cylinder. Thus a high-frequency stroke, in the order of 3 mm in length is imparted to the pump plunger. In a similar manner, a second control magnet imparts a fast reciprocating motion to its armature which carries a cylindri-

Continued on page 46



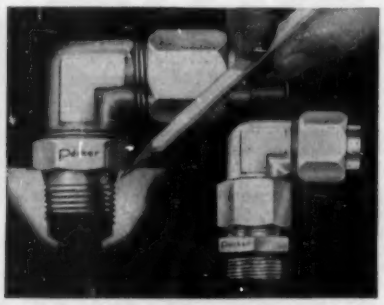
Be sure to see Parker for both tube and hose fittings!

Here, from one convenient source, you can get the most advanced hydraulic fittings available . . . both tube *and* hose. For example, new Parker *no-skive* Hoze-lok fittings require no stripping of rubber-covered hydraulic hose. They're faster, easier to use and *re-usable.*

Also, new Parker *straight-thread* tube fittings solve high-pressure hydraulic leakage problems resulting from tapered pipe threads. *Straight* threads are available on Triple-lok (the industrial standard flare tube fitting) and on Ferulok (flareless fitting for heavy steel tubing).

Parker
Hydraulic and fluid system components

No-skive Hoze-lok fittings need no stripping of hose covers. Only two simple steps complete the make-up. Re-usable.



Straight-thread tube fittings provide leakproof, trouble-free connections. No overtightening. O-ring makes the seal.

TUBE & HOSE FITTINGS DIVISION
Section 422-A
The Parker Appliance Co.
17325 Euclid Ave., Cleveland 12, Ohio

☐ Please send *no-skive* Hoze-lok Bulletin No. 4402
☐ Straight-thread fittings Catalog No. 4301

NAME_____

COMPANY_____

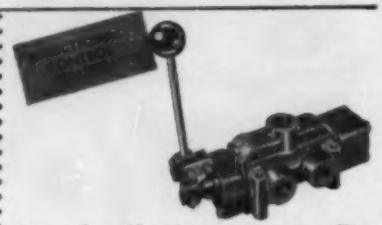
ADDRESS_____

CITY_____ STATE_____

ADEL *Industrial Hydraulic Equipment*

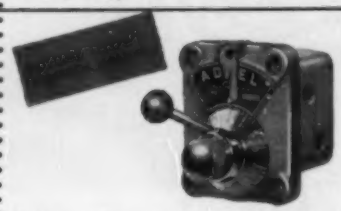
for PEAK PERFORMANCE ADEL Hydraulic Valves and Pumps are setting new and ever higher standards for precision in manufacturing and efficient performance in operation. Following are but a few of the wide variety of models to meet all operating conditions.

For 1000 psi service with rated capacities at 1800 rpm of from 1.5 to 46.8 gpm.

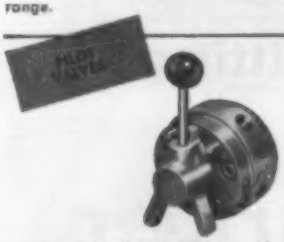


4-way valves with spring-centered, spring-offset, and 1, 2, or 3 position detent action. 1500 psi. Flows to 28 gpm.

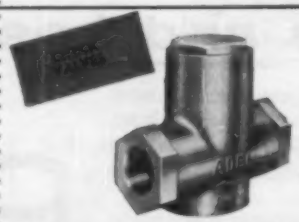
Relief, Sequence and Unloading valves. Direct or remote operation, 50 to 1500 psi range.



Compensated type maintains constant flow over wide differential pressure range. No drain line required. 1500 psi.



2 or 3 position detent. With or without dog or lever. Can be used as 4-way valve in small circuits. 1000 psi.



Valves allow free flow in one direction only. Many variations available. 3000 psi.

For complete engineering specifications and counsel, Address: ADEL PRECISION PRODUCTS, DIVISION OF GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, California.

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Manufacturers of Industrial Hydraulic Valves and Pumps

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TRI-STATE SUPPLY COMPANY, BROOKLYN 33, N. Y.

BRIEFS / continued

cal, two-port slide valve equipped with buffer springs, and this also reciprocates at 100 strokes per second. To take care of any leakage of oil, either past the actuator piston or past the piston of the plunger pump, two check valves are incorporated below the control valve assembly. Through these oil can enter the closed circuit to make good any leakage losses. Connected into the electrical circuit of the second magnet are two resistors and a capacitor and the effect of these is that the reciprocation of the control magnet is either ahead of or behind the pump reciprocation by 90 degrees or half a stroke.

The speed at which the actuator cylinder moves is dependent upon the load to be handled. The maximum load that can be handled by the Hydromagnet is 250 pounds.

• **Applications**—Unit is especially suitable as an actuator or remote control positioner for straight line motions, linkages and power transmissions and on such devices as dampers and gate valves in fluid lines. ▼▼▼

Hydraulics In Mining Machinery . . .

. . . is the title of a paper to be given by C. B. Frellsen at the January 31 meeting of the Fluid Power Division, ASME Philadelphia Chapter.

C. B. Frellsen

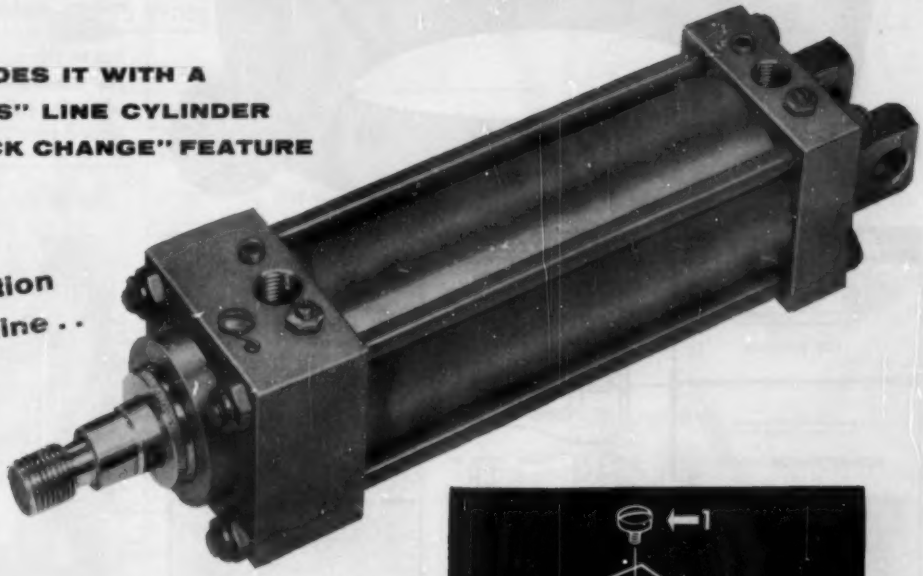
Frellsen, chief hydraulic engineer, Joy Mfg. Co., has been with the company for many years and

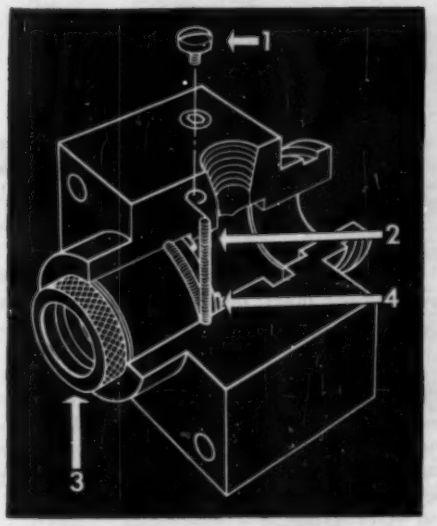
Continued on page 48

Minute Maintenance
CUTS COSTLY DOWNTIME . . .

EASY DOES IT WITH A LINDBERG "S" LINE CYLINDER WITH THE "QUICK CHANGE" FEATURE

Newest addition to a proven line . .

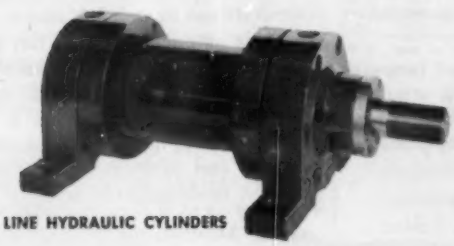




That's right, with a Lindberg "S" Line cylinder you can replace, if necessary, "U" cup Rod Packing, "U" cup Wiper, Cartridge Seal or the entire Rod Cartridge Assembly *in minutes*, without special tools or equipment.

HERE'S HOW: Remove Retaining Screw (1) (see cutaway, right) • Strip out Rod Cartridge Retaining Spring (2) • Twist Rod Cartridge (3) to free from Rod Cartridge Seal (4) and withdraw from Rod End Head • Reverse procedure to assemble and you're back in business—without a long, costly delay.

"S" Line cylinders last longer too. Chrome plated steel tube honed mirror bright • Chrome plated manganese steel Piston Rod • Tie Rods—pre-stressed to carry equal load • Full floating cushions • 23 other soundly engineered features mean extra life and lower per hour cylinder costs for you. 7 bore sizes to 6" —Rated 250 psi pneumatic, up to 1000 psi hydraulic—Mounting styles to fit your needs—Standardized mounting dimensions—Built to JIC recommendations. Send today for your copy of Bulletin S-101 on Lindberg Squarehead "S" Line Cylinders.



"H" LINE HYDRAULIC CYLINDERS

OTHER VERSATILE LINDBERG CYLINDERS

2000 PSI "H" LINE—Hydraulic—Shown left, bore sizes up to 8", with or without cushions, standard or 2:1 rods, mounting styles to fit your needs • "A" LINE—Air or Hydraulic—A rugged, non-tie rod cylinder for air pressures up to 150 psi and low pressure hydraulic service • MILL TYPE AND OTHER SPECIALS—For information, send outline of your requirements.

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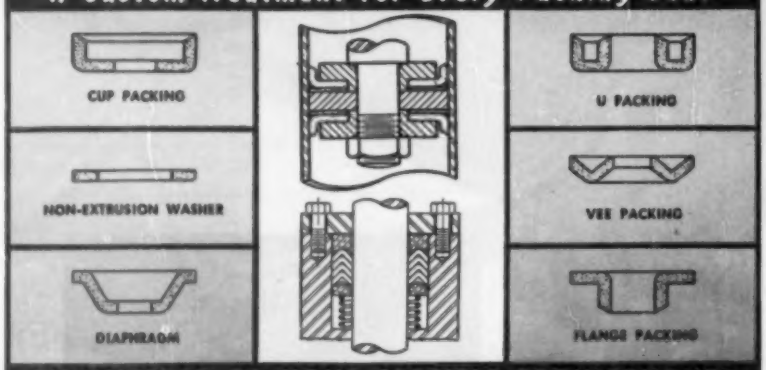
MARSH *Thermo* LEATHER PACKINGS

IMPREGNATED WITH SYNTHETICS!

616:

312:

A Custom Treatment for Every Packing Job!



ENGINEERED TO YOUR SPECIFIC REQUIREMENTS

616: Has a synthetic rubber impregnated into thermo leather. Temperature will not take out this rugged treatment. At the same time it stays flexible at low temperatures of −65° without becoming hard or brittle. 616 is very resilient, springy and tough . . . resists abrasion. Used for oils, new synthetic fluids, aircraft oils, air service and resists solvents.

Makes very fine cups, vees, "U" packings, flange packings and non-extrusion back-up washers.

312: Has a synthetic impregnated into the thermo leather, one of the first developed by Marsh. It is the accepted standard in many hydraulic and pneumatic installations. Its temperature range is satisfactory for most standard applications. This utility treatment makes fine cups, flange packings and "U" packings. It is a resilient but firm packing. Used for air, oil and water service.

Marsh has developed many treatments of different combinations for leather packings. Marsh has the know how of half a century in packing manufacture and can help you with your special problem.

Thermo leather without any treatment will withstand the highest temperature range of any other known leather. It is condensed in both area and thickness to create toughness and high tensile strength. It remains permanently flexible without drying out or becoming hard. No special lubricants required.

We produce packings to adopted dimensional standards.

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BRIEFS continued

has extensive experience in fluid power applications. He holds a B.S. degree in Electrical Engineering from Illinois Institute of Technology, and has made outstanding contributions in applying hydraulics to the mining machinery field. His interest in fluid power started when he joined Joy and has continued ever since. ▼▼▼

To streamline operations in sheet metal shops, Niagara Machine & Tool Works have developed an air powered notching and punching machine. A foot valve operates the unit and enables operator to locate material with both hands. Machine operates on shop pressure of 80 psi.

Air Power Solves Gear Handling Problem

Automatic loading of spur or helical internal gears on shaving machines presented a problem in meshing the teeth of the gear with the shaving cutter. Engineers at National Broach & Machine solved this problem through the use of pneumatics. An intermediate air-powered loading sleeve mechanism receives the gears from a magazine feed, hangs them on the cutter and provides the solution to the meshing problem.

• **Operation:** Internal gears to be shaved are loaded in a magazine where they roll by gravity to a position in front of an air-powered plunger. Plunger pushes

Continued on page 52

GAST ROTARY AIR MOTORS, COMPRESSORS, VACUUM PUMPS OFFER BIG ADVANTAGES AS ORIGINAL EQUIPMENT ON HUNDREDS OF PRODUCT APPLICATIONS . . .

AIR MOTORS

2 TYPES, 5 SIZES—TO 3 HP

Explosion-proof Gast Air Motors give you amazing compactness and light weight for hp rating. You get the advantage of a wide range of variable speeds plus low speeds without stalling. They'll start in any position. They can't burn out from overloads. Rotor vanes take up their own wear. Simple, almost service free, Gast Rotary Air Motors "fill the bill" in many equipment applications with low first cost.

specifications

model no.	output at 60 psi air pressure	net wt
1AM	0.11 hp @ 2,000 rpm 0.21 hp @ 5,000 rpm	1½ lb
2AM	0.13 hp @ 500 rpm 0.3 hp @ 1,500 rpm	5¼ lb
4AM	0.27 hp @ 500 rpm 0.67 hp @ 1,500 rpm	7½ lb
6AM	0.4 hp @ 500 rpm 1.1 hp @ 1,500 rpm	17 lb
8AM	1.0 hp @ 500 rpm 2.5 hp @ 1,500 rpm	25 lb

1AM-NCC-11

4AM-FCC-1C

2AM-NCC-16

AIR COMPRESSORS

5 TYPES, 16 SIZES—TO 30 PSI

Integral (motor-pump)—Compact, light weight, efficient "package" units. Vanes take up their own wear. Compressor rotor mounted on motor shaft for quiet, pulseless air delivery.

Light-Duty — For intermittent service. Quick pick-up, positive displacement. Resemble heavy-duty models but without fans or deep cooling fins, not needed for brief operating periods. Simpler lubricator. (Not illustrated)

Heavy-Duty—Fan-cooled—For long, continuous operation. Rotary design gives more air per lb., per hp. Automatic lubricator has self shut-off.

specifications

model	model no.	cfm	rec. max. pressure psi: continuously	rec. max. pressure psi: 10 minutes on-off	hp	net wt*
Integral (motor-compressor)	0406	0.6	15	20	1/12	16 lb
	0211	1.3	15	25	1/6	22 lb
	0321	2.2	20	25	¼	25 lb
	0521	3.8	15	20	⅓	26 lb
light-duty	0240	2.0	10	20	¼	8 lb
	0440	3.8	10	20	⅓	10 lb
	0740	5.6	7	10	½	11 lb
heavy-duty fan-cooled	0465	3.8	25	30	½	18 lb
	0765	5.6	10	15	½	18 lb
	1065	8.3	25	30	1	34 lb
	2065	17.0	15	20	1½	54 lb
	2565	21.0	15	20	2	54 lb

*Weight without base or motor, except integral models.

0211-P3A-G10X

1065-P20A-39

VACUUM PUMPS

7 TYPES, 16 SIZES—TO 28 IN.

Integral (motor-pump) — Compact, light weight, "packaged" units. Save mounting cost and time. Especially suited for portable equipment. Rotor mounted on motor shaft. Rotary design gives quiet operation, pulseless vacuum. Vanes take up own wear.

Light-Duty — For intermittent service. Give quick pick-up, trouble-free performance. Resembles heavy-duty models but without external fans or deep cooling fins. Simpler lubricator. (Not illustrated)

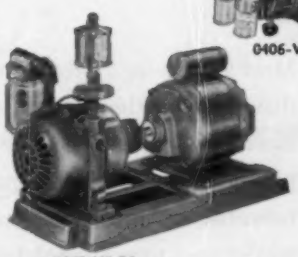
Heavy-Duty-Fan-Cooled — Built for continuous service, dependability, minimum maintenance. Forced air cooling, deep cooling fins. Automatic lubricator has self shut-off.

specifications

model	model no.	cfm	rec. max. vacuum, in hg.: continuously	rec. max. vacuum, in hg.: 10 minutes on-off	hp	net wt*
Integral (motor-pump)	0406	0.6	15	25	1/12	16 lb
	0211	1.3	15	27	1/6	22 lb
	0321	2.2	28	—	¼	27 lb
	0521	3.8	28	—	⅓	28 lb
light-duty	0240	2.0	15	26	¼	9 lb
	0440	3.8	15	26	⅓	11 lb
	0740	5.6	10	26	½	12 lb
heavy-duty fan-cooled	0465	3.8	26		¼	18 lb
	0765	5.6	28		½	18 lb
	1065	8.3	28		½	34 lb
	2065	17.0	28		1	54 lb
	2565	21.0	28		1½	54 lb

*Weight without base or motor, except integral models.

0406-V-2-154X



1065-V4-34

OIL-LESS AIR PUMPS

3040-V103

Available in 5 sizes, separate drive — 2 sizes, integral - motor. Write for "Oil-less" Bulletin.

Gast offers you specialized experience in air motors, compressors and vacuum pumps for original equipment. Based on 9 design types and 17 sizes, over 200 different Gast models go into production each year. With the various accessories, these models have a tremendous number of applications.

"Air may be your Answer!" Write for detailed information on your application.

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GAST MANUFACTURING CORP. P.O. Box 117-D, Benton Harbor, Mich.

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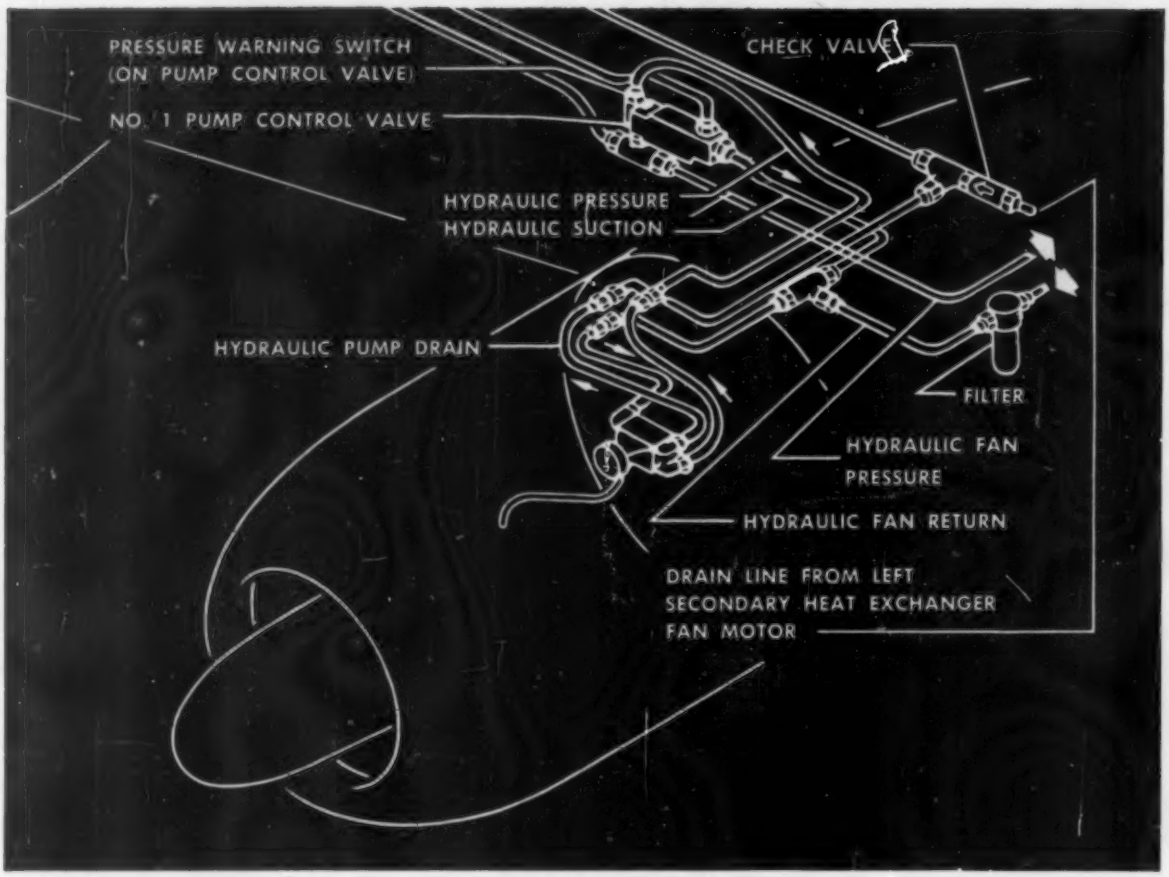

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Plan a Purolator filter as part of your system

Most hydraulic systems break down immediately unless they are protected by adequate filtration. And it takes more than correct filter placement to assure adequate filtration — it takes the best filter you can get as well. That's why it pays to use Purolator Micronic® filters. They give you the fullest protection. The reason? Micronic elements — which provide controlled porosity and maximum filtration effectiveness with removal of particles as small as .000039 inch. And because they're made of plastic-impregnated cellulose, Purolator's Micronic elements are not affected by high temperature or water.

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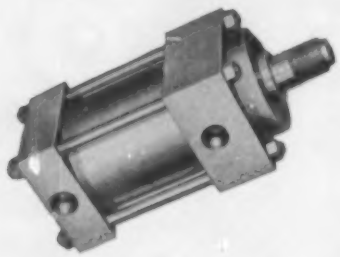

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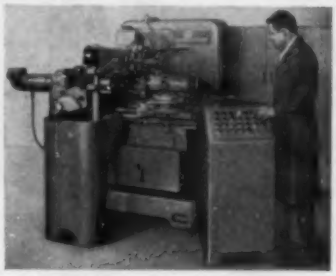
BRIEFS continued

gears, one at a time, into the loading sleeve, which is mounted on a swinging arm and swung through an arc by air-cylinder controlled linkage. Pushing an unshaved gear into the sleeve at this raised position causes a finish-shaved gear in the other end to be deposited in an unloading magazine where the shaved gears roll to a location at the front of the machine.

In the next loader sequence, the sleeve holding the unshaved gear is swung downward by the air cylinder into line with the work spindle centerline. A finish-shaved gear in the chuck on the work head is ejected by another air cylinder into the sleeve. Entry of the finish-shaved gear ejects the unshaved gear in the other end of the sleeve into mesh with the shaving cutter, where it remains hanging on the cutter.

Then the loading sleeve is raised back to the load position. The internal gear and shaving cutter are then advanced as a unit toward



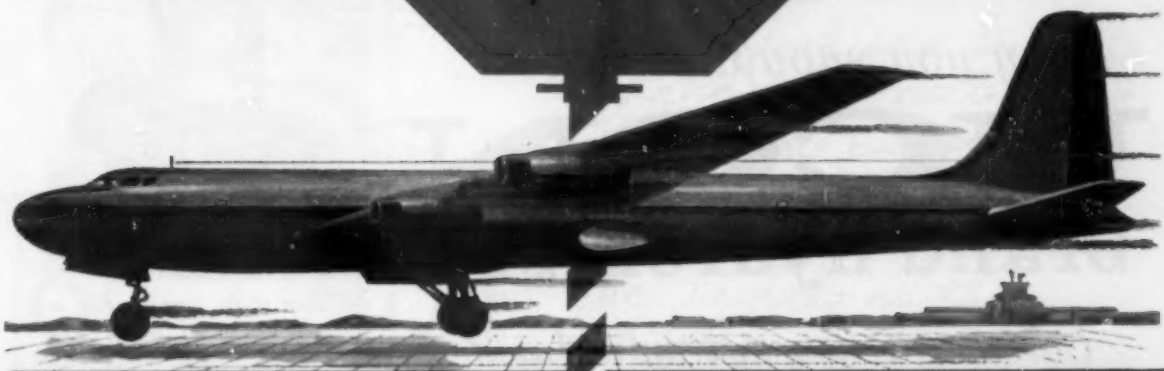
the chuck in the workhead and the gear is chucked, ready for the shaving operation, with the cutter in mesh with the gear. At the end of the shaving operation, the cutter spindle is backed out of the gear and returned to its original position for the loading of another unshaved gear. ▼▼▼

Continued on page 54

Necessity to strengthen the roofs of the modern hard top convertible has led the Chrysler Corporation to install this high speed automatic radial draw former, built by the Cyril Bath Company. The piece being formed—a drip molding—is fed automatically into the machine where the heads are gripped by gripper heads and are then stretched hydraulically under a pull of six tons. This method of draw forming is already widely used in the aircraft and heavy transportation industries.

CONTROLLED STOP

...with Bendix-Pacific POWER BRAKING



Bendix-Pacific has maintained its leadership in keeping pace with today's high speed deceleration problems, providing the latest aircraft with extra fast braking response.

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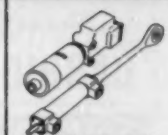
POWER BOOSTED MASTER BRAKE CYLINDER

COMBINATION POWER AND MASTER BRAKE VALVE

EMERGENCY BRAKE (HYDRAULIC AND PNEUMATIC)



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why you should switch to

UCON

brand hydrolubes

Carbide's Safety hydraulic fluids

1) The *fire-resistance* of water-base Ucon Hydrolubes has been proved by years of severe, exhaustive laboratory tests. In actual service, Ucon hydrolubes have prevented serious fires and injuries during more than eight years of routine use.

2) Ucon Hydrolubes have *no harmful effects* on packings and seals. Leakage losses are often lower than with other hydraulic fluids.

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4) Ucon Hydrolubes are made in *three standard viscosity grades*—200, 300, and 550 S.U.S. at 100°F. Other grades can be supplied to fit specific needs.

5) Ucon Hydrolubes have *high viscosity indexes*—150 to 160.

6) Ucon Hydrolubes are *good lubricants*. Special anti-wear agents provide satisfactory pump life and performance characteristics.

7) Ucon Hydrolubes contain effective liquid and vapor phase *corrosion inhibitors* for the common metals.

8) Ucon Hydrolubes have *low pour points*—a must for use at low temperatures.

Ucon Hydrolubes are the answer to the problem of improved safety with hydraulic fluids. Get all the facts. Write *today* for the booklet "Ucon Hydrolubes Spell Safety," Form 40134.

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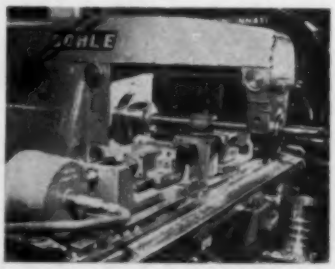
BRIEFS continued

Hydraulically Operated Metal Test Unit

• **Compact Design**—This cup tester is a bench-mounted hydraulically operated unit. Power is supplied by a 1/6 hp motor mounted on the rear of the base which incorporates the tank of hydraulic oil. Two simple valves on

the front of the base provide infinite control of the testing operation. Net weight of unit is less than 200 pounds.

• **Testing Thin Metals**—Designed specifically—by Steel City Testing Machines—for testing thicknesses from .003 inch to .062 inch, this equipment can be used for testing many different types of metals including copper, brass, aluminum, carbon steel and others. ▼▼▼



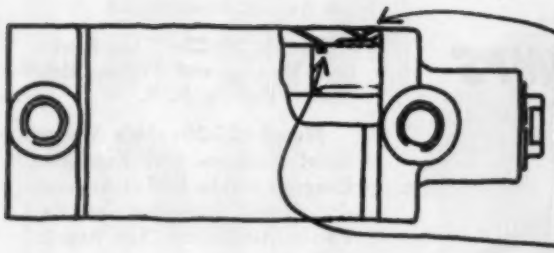
AIR-HYDRAULIC powered machine vise is shown holding work piece for milling operation. Wilton Tool designed these units to provide fingertip control, instant action, and 9000 pounds of locking force wherever needed. Vise bolts quickly to any standard machine, so that one unit can be used for many machining operations.

INTER-OFFICE

Engineering Department

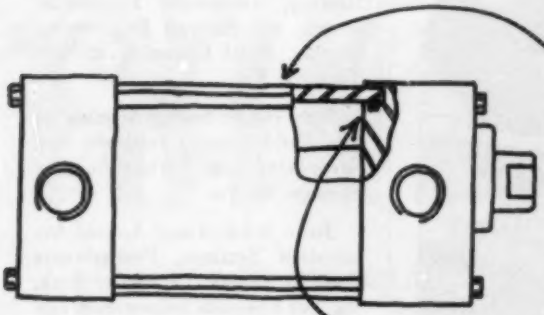
MEMO

Jim - Here's why I think Pathon Hydraulic Cylinders fit our long stroke applications better.



Pathon head is attached by a single screw thread.

Head seal is a true static seal - will give us much longer life.



Higher pressures will stretch the tie-rods on this cylinder - heads will move relative to the tube

This makes head seal dynamic - subject to wear and subsequent trouble

NOTE THIS JIM: Pathon Cylinders fit the bill in shock loads too. We can use the greater strength that Pathon single screw thread attaching method provides.

Tell purchasing to write

PATHON MANUFACTURING CO.
2823 PACIFIC AVE.
CINCINNATI 12, OHIO

ask for catalog #22-A

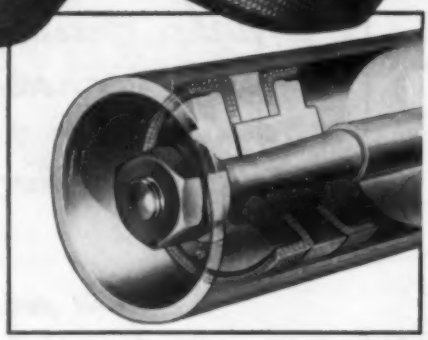
Ψ could designate P. S. I. - 101

PUMCUP ADVANTAGES

now yours for

- ***HYDRAULIC CONTROLS***
- ***AIR CYLINDERS***
- ***RECIPROCATING PUMPS***

Two common Pumcup types: conventional and 45° bevel type . . . available in a complete range of sizes and texture-engineered compositions.



Cutaway view of typical Pumcup installation resulting in prolonged high efficiency.

TAKE it from experienced users, Darcova Pumcups offer payoff advantages that can't be equalled! For example, they last many times as long as ordinary pistor packing..and they *hold peak efficiency* from start to finish. Because of the resulting production and maintenance economies, plant after plant is standardizing on Pumcups.

Improved application of the cup principle does the trick. And Darcova Pumcups are *texture-engineered* in *a range of compositions* to meet most temperature-pressure-fluid conditions. And they are available in sizes and types exactly right for your particular equipment.

It will pay you to get *all* the facts. Just ask for Pumcup Bulletin No. 5503.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
TRADE MARK
PUMCUPS

BRIEFS / continued

Future Events

March 13-15: Spring Meeting National Fluid Power Association. Hollywood Beach Hotel, Hollywood-by-the-Sea, Florida. For information contact Barrett Rogers, Executive Secretary, 1618 Orrington Avenue, Evanston, Ill.

March 20-22: SAE Production Meeting and Forum, Hotel Statler, Buffalo, N. Y.

March 25-29: 10th Western Metal Congress and Exposition. Congress will be held at Ambassador Hotel, exposition at Pan-Pacific Auditorium, Los Angeles, Calif.

April 2-5: SAE Aeronautic Meeting, Aeronautic Production Forum, and Aircraft Engineering Display, Hotel Commodore, New York, N. Y.

May 8-11: Spring Meeting of The Fluid Control Institute, Inc. Greenbriar Hotel, White Sulphur Springs, W. Va.

June 9-14: Third Annual Automation Seminar, Pennsylvania State University, University Park, Pa. For complete information and registration contact Chester Linsky, assistant professor of industrial engineering.

September 9-12: SAE Tractor Meeting and Production Forum, Hotel Schroeder, Milwaukee, Wis.

September 9-13: 12th Annual Instrument Automation Conference and Exhibit of The Instrument Society of America. Public Auditorium, Cleveland, Ohio.

October 1-5: SAE Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display, The Ambassador, Los Angeles, Calif.

October 17-18: The 13th Annual Conference on Industrial Hydraulics. Hotel Sherman, Chicago, Illinois. Raymond D. Meade is Conference Secretary.

November 4-6: SAE Transportation Meeting, Hotel Statler, Cleveland, Ohio. ▼▼▼

BIGGER THAN YOU THINK

Skinner solenoid valves are compact, tiny and lightweight.

But don't be misled — they'll easily outperform other valves that are much larger and heavier. Built to withstand high voltages and temperature extremes, Skinner valves provide leakproof, trouble-free operation through millions of cycles.

And being small, they are easily adaptable to your most compact equipment design. Call in a Skinner engineer on all your valve problems *first*. He can draw from over 100,000 variations . . . all of them *big in capacity, power and performance.*

Write for the new Skinner Solenoid Valve Catalog. On your letterhead, please.

SKINNER SOLENOID VALVES

THE CREST OF QUALITY

SKINNER ELECTRIC VALVE DIVISION • SKINNER CHUCK COMPANY

105 Edgewood Avenue
New Britain, Conn.

WORLD-WIDE REPRESENTATION

Circle 163 on Reader Service Card

All Leather Impregnations ... but *all different*

Leather can be impregnated by many materials, four of which are shown here. Of the numerous compounds based on these materials, only one will best qualify your packing or oil seal to withstand the pressures, retain or seal the medium and meet the other requirements of your application. Selection of the proper leather and impregnant for your operating conditions is a job that IPC specializes in. Let our technical staff analyze your requirements and custom-engineer the best impregnated leather packing or oil seal for your application.

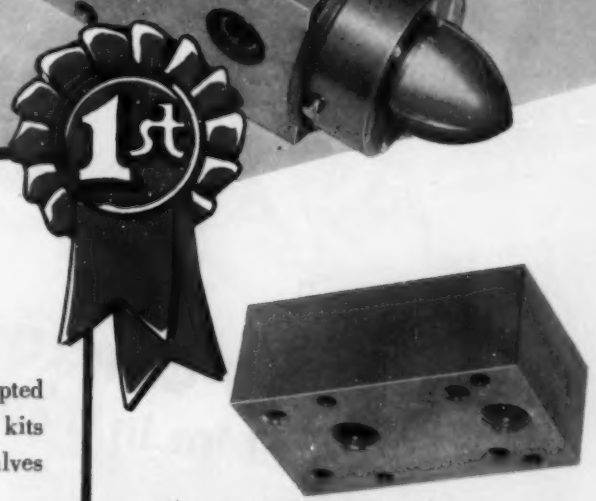
INTERNATIONAL PACKINGS CORPORATION

Bristol, New Hampshire

P1

Another WATERMAN WINNER

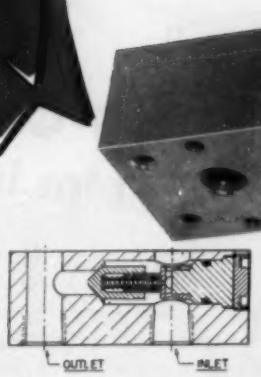
Adjustable Flow Regulator



An adjustable flow regulator adapted for manifold mounting. Sub-plate kits are furnished with built-in check valves for free reverse flow.

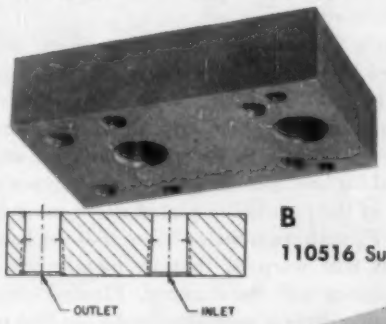
They are interchangeable, dependable, lightweight and easily installed.

Either right or left hand rotation of control handle is available. Maximum or minimum flow adjustable by 180° movement of this control handle.



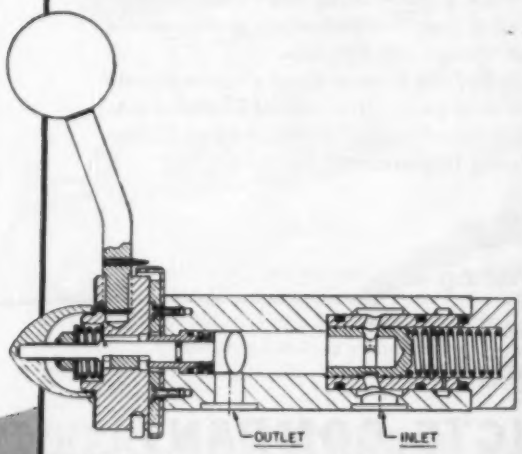
A

110534 Sub-Plate Kit with built-in check valve for free reverse flow.



B

110516 Sub-Plate Kit.

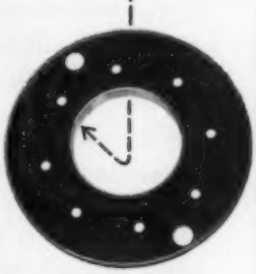


Write for illustrated bulletin A describing the many valuable features of this Adjustable Flow Regulator.

WATERMAN ENGINEERING COMPANY

725 CUSTER AVENUE • EVANSTON, ILLINOIS

a FRETTING-CORROSION problem had him in a spin



Finding a wear-resistant coating for turbine engine shaft seals posed a serious problem for an aircraft engine manufacturer. Even the hardest alloys were subject to fretting corrosion and had to be replaced after a few hours of service.

This fretting-corrosion problem was solved by having the bearing surface of the seal Flame-Plated by LINDE. By this special detonation process, particles of tungsten carbide are literally *blasted* onto almost any metal surface. Most important, the temperature of the part being plated never exceeds 400° F., so there is little chance that the base metal will warp or that its metallurgical properties will be changed. Flame-Plated tungsten carbide coatings can be applied in thicknesses from .010 to .002 inches. Coatings can be used in the as-coated condition (125 microinches rms) or ground and lapped to a 0.5 microinch finish.

If your design involves metal parts subject to extreme wear, heat, or fretting corrosion, perhaps Flame-Plating can eliminate some or all of your "headaches"—or make possible some completely new idea.

To find out, write us about your wear problem or request a free copy of LINDE's booklet, "Flame-Plating," F8065. Address Flame-Plating Department.

Flame-Plating *by* Linde

LINDE AIR PRODUCTS COMPANY

A Division of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, New York

In Canada: Linde Air Products Company, Division of Union Carbide Canada Limited, Toronto

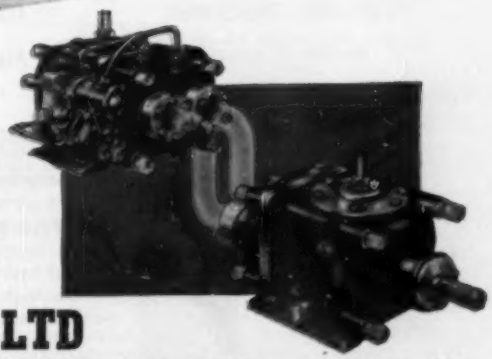
The term "LINDE" is a registered trade-mark of Union Carbide and Carbon Corporation

'VSG'

Regd. Trade Mark

Serving Modern Industry

Infinitely VARIABLE SPEED HYDRAULIC TRANSMISSION GEARS



Extensive new plant has recently been installed in Sheffield, England, by Firth Vickers and Samuel Fox. The above illustrations show one of the Pickling and Annealing Lines. For precise speed control over a wide range and for accurate synchronisation of each section drive 'VSG' Hydraulic Transmission Gears were selected.

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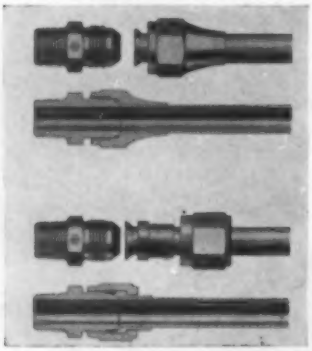
Main Stocks are Carried in Montreal and Vancouver.

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.



FLARED TUBE FITTINGS . . . with straight threads

Designation: Flare-Twin

Features: Straight-thread type fittings in popular styles and sizes for SAE O-ring boss design. Withstands higher operating pressures without using backup rings. Offers easier assembly, minimum close coupling, less O-ring distortion, longer O-ring life and can be repeatedly assembled without affecting the seal. All styles are coated to resist corrosion and effects of various hydraulic fluids.

Specifications: Line offers choice of 2 or 3-piece types, in a range of styles, including connectors, unions, elbows and tees, in sizes ⅛ to 2-inches. Units meet SAE 37° flared JIC steel tube fitting requirements for hydraulic service.

Weatherhead Company
Fort Wayne Division
Fort Wayne, Ind.

Circle 215 on Reader Service Card

AIR & OIL PILOT VALVES . . . offer continuous cycling

Features: Designed for pneumatic or hydraulic use, valves are unit constructed and spool operated. When last cylinder in sequence reinitiates the first cylinder, continuous cycling is possible without external timing. Machine runs at optimum speed with no overlapping possible.

Specifications: Standard bore size is ⅛-inch and both 3 and 4-way valves are available. Valve bodies and fittings are made of Duralumin, anodized to resist atmospheric corrosion. Spools are of mild steel, precision ground and hard chrome plated. Units are suitable for use with air or oil at pressures up to 250 psi.

Pneumatics Division
Baldwin Instrument Company Limited
Dartford, England

Circle 216 on Reader Service Card

OIL PUMP . . . has two elements

Designation: RG-15290

Features: Pump has mounting pad and drive for high pressure hydraulic pump. Lube element feeds oil to gas turbine engine bearings and hydraulic element supercharges the high pressure hydraulic pump. Both elements have built-in check valves and a pressure relief valve is incorporated in the hydraulic element. Pump is positive displacement, rotary vane type and mounts on accessory drive of gas turbine engine equipped with spline drive. Relief valve is set at 150 psi.

Specifications: Capacity at 3750 rpm, 60 psi discharge pressure: Lube element: 8.4 gpm; hydraulic element: 3.7 gpm. Displacement of lube element is 0.620 and hydraulic element 0.316 cubic inches per revolution.

Lear-Romec Division
Lear, Inc.
Elyria, Ohio

Circle 217 on Reader Service Card

Continued on page 64

MARVEL Synclinal FILTERS

Answer DESIGNERS' S. O. S.

For Dependable Protection on all Hydraulic and other Low Pressure Systems

Simple, Balanced Design . . . is the answer to the growing preference for MARVEL Synclinal FILTERS. Designers are specifying Marvel Synclinal Filters to assure minimum maintenance and maximum protection. Results show Marvel Synclinal Filters superiority in maintaining the greatest degree of cleanliness of liquids in all hydraulic and low pressure systems with minimum downtime. Furthermore, when filter servicing is necessary, Marvels can be easily disassembled, cleaned and reassembled by any workman in a matter of minutes. Line types operate in any position and may be serviced without disturbing pipe connections.

MEET J. I. C. STANDARDS

Again and again, Marvel Synclinal Filters have demonstrated they meet all requirements of the most exacting users, that today—OVER 750 ORIGINAL EQUIPMENT MANUFACTURERS install Marvel Synclinal Filters as standard equipment!

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G. P. M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer IMMEDIATE DELIVERY.

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

Catalogs containing complete data available on request

MARVEL ENGINEERING COMPANY

7227 N. Hamlin Ave., Chicago 45, Ill. **PHONE: Juniper 8-6023**

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated: (AH-1)

- ☐ Catalog #107—For Hydraulic Oils, Coolants, Lubricants.
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

Name ..... Title .....

Company .....

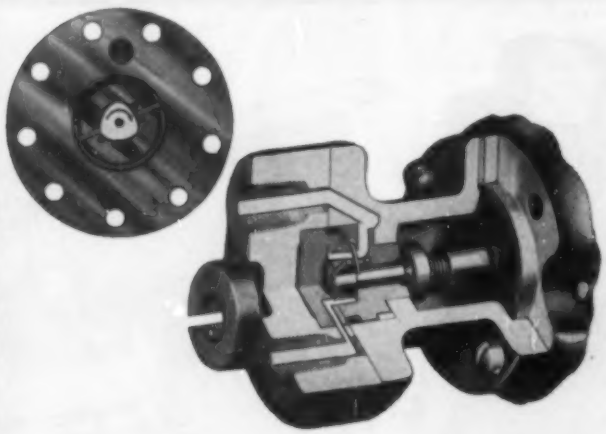
Address .....

City ..... State .....

WELDON

FLUID METERING PUMPS

Positive Displacement Rotor Type. For Industrial Applications, Aircraft Anti-Icing and Aircraft Fuel.



IT'S SO SIMPLE!

The rotation of the rotor draws the fluid in through two passages, filling the cavities formed by the three lobes of the rotor. This fluid is sealed within these small cavities until it is forced through the two outlet holes by the floating blades. The flow may be kept uniformly divided through two outlet ports, or may be combined internally for passage through a single port.

Compact • Light Weight

Send for Weldon Manual and Catalog with detailed specifications and installation drawings, covering the full range of Weldon pumps in various capacities. Specify your requirements.

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD · · · CLEVELAND 4, OHIO

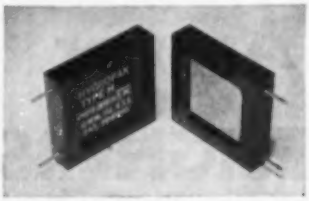
New Products / continued

HUMIDITY SENSING ELEMENT

. . . uses new type element

Designation: Hygropak

Features: Uses various type coatings to make elements of a wide range of resistances, from a few ohms for low voltage bridge type



circuits, to thousands of megohms for vacuum tube circuits. Normally, the element decreases its resistance with humidity. Element will operate over a wide range of temperatures up to 200 degrees F, with plastic case. Special glass unit can operate up to 600 degrees F. Bulletin gives information on development of the unit, with performance curves and circiut diagrams.

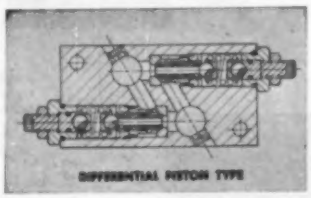
Photo-Crystals, Inc.
Geneva, Ill.

Circle 218 on Reader Service Card

DUAL RELIEF VALVES

. . . ease shock pressures

Features: Designed to relieve shock pressures occurring at control valves or motors, when control valves are suddenly reversed or blocked, or external load is applied to the motor. Units consist of two adjustable relief valves in one body. Each

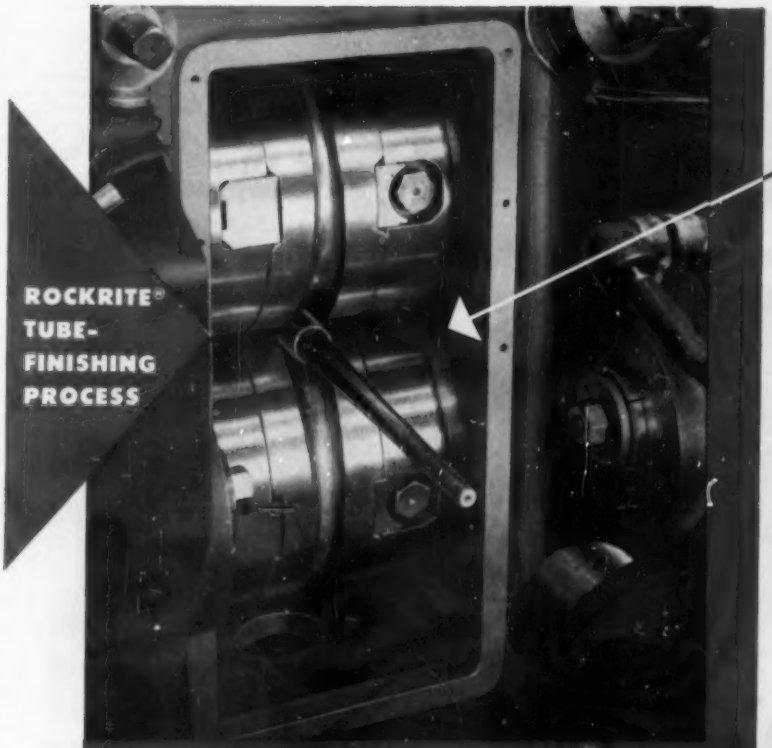


valve relieves in one direction, adjustable to the same or different pressures. When system pressure is exceeded, oil is relieved from one line and directed into the other line, eliminating connection to reservoir. Valves are available in either guided piston or differential piston types.

Fluid Controls, Inc.
Mentor, Ohio

Circle 219 on Reader Service Card

Continued on page 66



High quality begins here

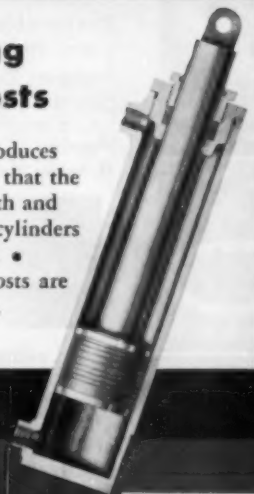
This tube, leaving the Rockrite reducer, has been cold compression rolled—with great metal displacement. Result: Better structure of the metal, precision dimensions, and excellent surface finish. It is a quality tube.

Rockdrawn® Quality Hydraulic-Line Tubing

Rockrite high surface finish tubes are precision cold drawn to produce Rockdrawn small-diameter tubing that is consistently of the highest quality.

Cylinder Tubing cuts honing costs

The Rockrite process produces such a high surface finish that the tubing can be cut to length and used as is for hydraulic cylinders with soft-packed pistons. • Machining and honing costs are always cut to a minimum.



Send for these bulletins.

PRECISION TUBING
Rockrite®
Rockdrawn®
TUBE REDUCING CORP.

TUBE REDUCING CORPORATION
WALLINGTON, NEW JERSEY
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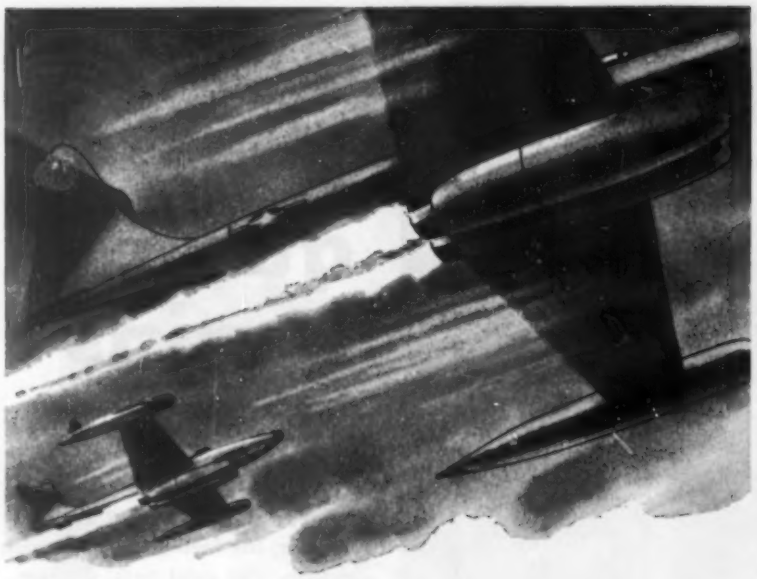
TR-165



hydraulic packings that "STAY PUT"

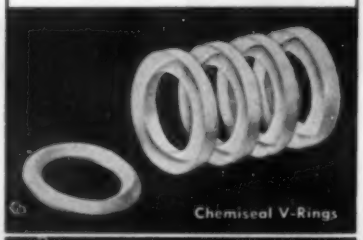
Chemiseal hydraulic packings . . . made of chemically impervious duPont TEFLON . . . have zero swelling in all hydrocarbons, new synthetic hydraulic fluids and solvents. Require no chemical inspection. Unsurpassed anti-friction properties, are tough, resilient, nonflammable, long wearing. Wide service temperature range from minus 110° F to plus 500° F.

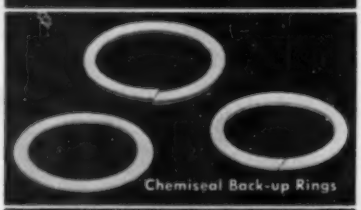
CHEMISEAL V-Type Packings are ideal for either manual or automatically operated valves. Seal with low gland pressure and operating torque. Square end TEFLON adaptors are available if required.

CHEMISEAL Back-up Rings prevent "O"-ring extrusion and greatly lengthen their life. Spiral, solid and split ring types are available in all commercial and AN sizes.

CHEMISEAL Slotted O-Rings (patented) provide greater cross-sectional deformability, thermal expansion compensation and automatic pressure-sealing action. Designed to fit standard AN grooves. Write for further information.

made of duPont TEFLON


Chemiseal V-Rings


Chemiseal Back-up Rings

Chemiseal Slotted O-Rings

UGS

UNITED STATES GASKET CO.

CAMDEN 1, NEW JERSEY

New Products / continued

SERVO VALVE
. . . has dry coil construction

Features: Valve utilizes an isolation diaphragm to bar all hydraulic fluid from coil and magnetic circuitry. Torque motor operates entirely in air media, allowing free

use of fluids without danger of coil deterioration. Sleeve, spool and adjustments in power stage are all stainless steel, increasing null stability at varying temperatures.

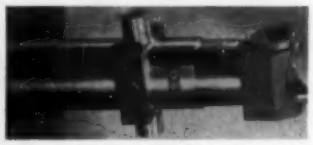
Hydraulic Research and Manufacturing Co.
Burbank, Calif.

Circle 220 on Reader Service Card

NEW CUSHION
. . . takes high velocity impact

Designation: Model 28112-16 Liquid Spring Shok

Features: Designed to cushion impact of 10,000 pound mass moving into a mechanical stop, unit easily absorbs 22,500 in.-lbs. of energy at velocity of 360 inches per sec-



ond. Cushion is compact, self-contained and provides a 10,000 pound spring with a 1000 pound preload and an integral heavy duty shock absorber. Unit uses liquid compressibility and dampening. Operation is at low internal pressure assuring long life. Unit is 3½ inches in diameter and 14 inches long, excluding trunnions.

Taylor Devices Incorporated
North Tonawanda, N. Y.

Circle 221 on Reader Service Card

Continued on page 70

Star JACK COMPANY INC.

Plant
River Grove
Illinois

Sales Office
420 Lexington Avenue
New York 17, N. Y.

★

Star products are building a reputation for quality, efficiency, and safety at reasonable cost.

Consult STAR on problems involving hydraulic or pneumatic lifting, pushing, or pulling mechanisms.

DESIGNERS AND MANUFACTURERS OF SPECIAL HYDRAULIC AND MECHANICAL EQUIPMENT

Distributor Areas Available

HYDRAULIC AND AIR-DRIVEN COMPONENTS · STAR JACK

hydraulic cylinders

A—HEAVY DUTY DOUBLE-ACTING CYLINDERS for push-pull service. 2" to 4" bore, 3,000 psi. End mountings to suit customers' requirements.

B—CENTER HOLE RAMS FOR PULLING AND PUSHING, 30 to 100 ton capacity. 3" to 12" hydraulic stroke. High pressure, self-sealing, quick coupler allows rapid connecting and disconnecting of pump and ram. Spring or hydraulic retraction.

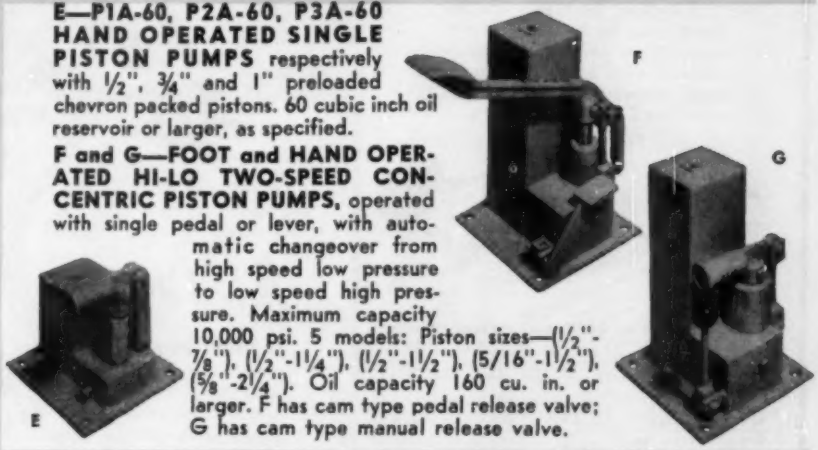
C—SOLID HYDRAULIC RAMS, 10 to 150 ton capacity, 10,000 psi. 2" to 12" hydraulic stroke. Suitable for operation with Star Hydraulic Pumps.

D—HEAVY DUTY SINGLE-ACTING CYLINDERS for machine builders, farm machinery, road equipment, and aircraft. 2" to 4" bore, 3,000 psi. End mountings to suit customers' requirements.

hydraulic pumps

E—P1A-60, P2A-60, P3A-60 HAND OPERATED SINGLE PISTON PUMPS respectively with 1/2", 3/4" and 1" preloaded chevron packed pistons. 60 cubic inch oil reservoir or larger, as specified.

F and G—FOOT and HAND OPERATED HI-LO TWO-SPEED CONCENTRIC PISTON PUMPS, operated with single pedal or lever, with automatic changeover from high speed low pressure to low speed high pressure. Maximum capacity 10,000 psi. 5 models: Piston sizes—(1/2"-7/8"), (1/2"-1 1/4"), (1/2"-1 1/2"), (5/16"-1 1/2"), (5/8"-2 1/4"). Oil capacity 160 cu. in. or larger. F has cam type pedal release valve; G has cam type manual release valve.



industrial jacks

H—HF500 FOOT OPERATED SELF-CONTAINED LIFTING UNITS for materials handling, professional equipment, conveyors, chutes, elevators, etc. 1 ton capacity, available in strokes up to 40". Base mounting to suit customers' requirements.

J—HYDRAULIC JACKS of 1 1/2 to 20 tons capacity. Suitable for pressure gauges where specified.

K—HYDRAULIC 2-SPEED JACKS of 30 to 100 ton capacity. With dual release valves suitable for pressure gauges where specified.

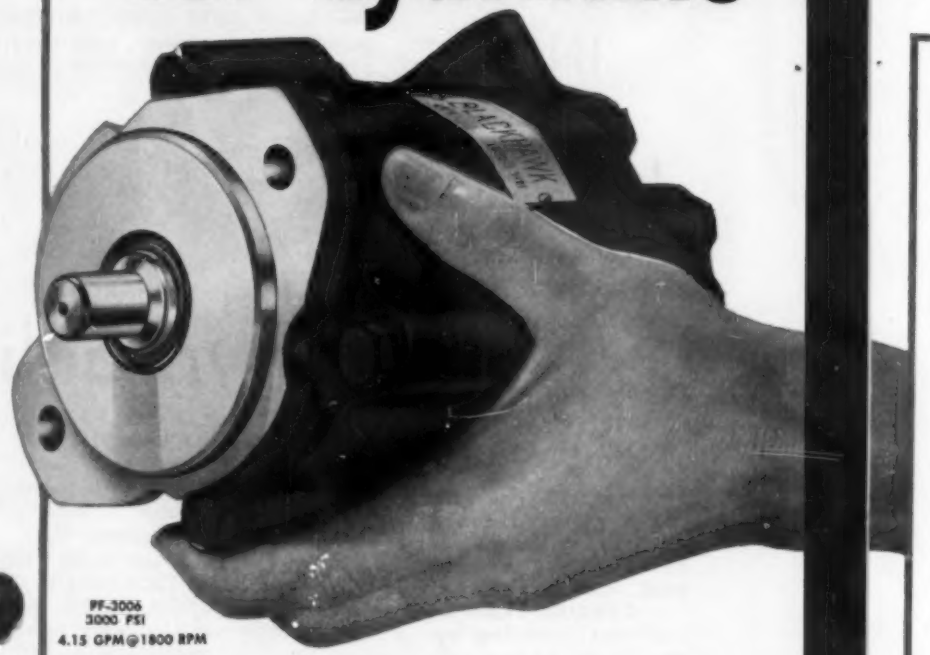
Circle 171 on Reader Service Card

NEW efficiency! New for hydraulic

DYNEX announces a new line of BLACKHAWK 3000 psi piston pumps

These units are capable of operating under severe conditions up to 3000 psi. They provide the hydraulic circuit designer with flexibility never before available. Offering efficiencies over 90%, these units can be used with smaller components . . . heating problems are reduced plus many other advantages. They are ideal for agricultural, construction equipment, materials handling, test stand and press applications.

SPECIFICATIONS — 3000 psi PISTON PUMPS					
DESCRIPTION	PF-3003	PF-3006	PF-3008	PF-3016	PF-3021
MAX. intermittent pressure (psi)	3000	3000	4500	4500	4500
Rated pressure (psi)	2000	2000	3000	3000	3000
Displacement per rev. (cu. in.)	.382	.597	.810	1.568	2.095
Maximum rpm	2200	2200	2200	1800	1800
GPM @ 1800 rpm (max.)	2.65	4.15	5.7	10.9	14.7
Maximum hyd. hp.	5.2	8.2	13.8	24.5	33.0
Weight (lbs.)	25	25	38.5	75	95



PF-3006
3000 PSI
4.15 GPM@1800 RPM

At last!

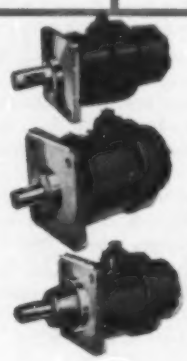
A piston pump in the price range of gear and vane types

Surprising new economies and new design advantages for hydraulically controlled equipment are created by this unique Blackhawk piston pump. Its outstanding design characteristics are available . . . at an *unusually* low cost . . . because of large-scale production.

The compact PF-3006 pump has proven extremely rugged under severe operating conditions, withstanding continuously repeated shock pressures through millions of cycles.

. . . and a broadened line of 6000 PSI piston pumps

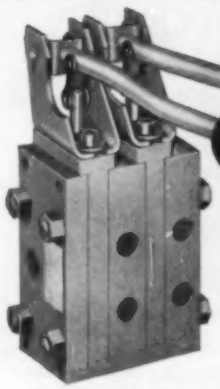
High efficiency for hydraulic circuits



SPECIFICATIONS — 6000 psi PISTON PUMPS				
Series	P-237 (PF-6006)	P-280 (PF-6011)	P-240 (PF-6015)	PF-6028
Rated pressure (psi)	6000	6000	6000	6000
Displacement per rev. (cu. in.)	.576	1.112	1.485	2.803
Maximum rpm	2200	1800	1800	2400
GPM @ 1800 rpm (max.)	4.2	7.3	9.5	20.5
Maximum hyd. hp.	13.8	24.5	33.0	90.0
Weight (lbs.)	38.5	75	95	150

These piston pumps do far more than answer growing demands for greater pressures. They also bring low cost as compared to other piston pumps — plus up to 95% overall efficiency. Pressures developed by these pumps solve many of the design engineer's most acute problems, dramatically reducing size of valves, fluid lines and cylinders.

low cost! New flexibility circuits

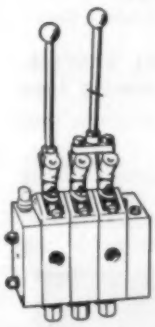


NEW!

BLACKHAWK "VALVBANK" for 3000 psi circuits

Low cost . . . low internal leakage . . . compact construction . . . single or multiple sections.

Blackhawk new Series VM-3506 Sliding Plate Valve designed for 6 gpm, 3000 psi circuits, is a precision-built 3 position (raise-hold-lower) directional valve.



Series V-68 Poppet-type "Valvbank" for 6000 psi

This positive-sealing, directional control valve provides single and double-acting control units for pressures up to 6000 psi. Features integral relief valve with single or multiple sections.

How to make a low cost multiple pump

On all 6000 psi pumps, one or more pistons can be isolated to provide two or more sources of flow by simply removing the check-ball retainer and replacing with a Blackhawk isolating valve VC-6000.

DELIVERIES FROM STOCK

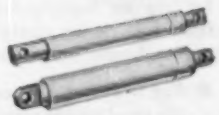
Manufacturing has already expanded so that Dynex offers FROM-STOCK-DELIVERY of most of the components cataloged. And, because of continuous production of standardized items, we can serve both large quantity OEM requirements and individual applications from constantly replenished inventory. In addition, authorized Blackhawk service depots are strategically located throughout the nation . . . and are equipped to provide fast, low-cost repair service.

COMPONENTS AVAILABLE INDIVIDUALLY OR IN COMPLETE CIRCUITS

Dynex offers a long line of standardized hydraulic components — pumps, motors, valves and cylinders. Quality construction and design refinements gained through years of experience offer long life under most rugged conditions. They are furnished individually or in complete circuits.

Write, wire, phone. You are invited to contact us for engineering counsel and added data for the successful application of Blackhawk hydraulic components. Write for free Bulletin No. DG-1 for full information on this extensive and continually expanding line.

Hydraulic cylinders — single or double-acting with exclusive leakproof designs for pressures up to 6000 psi.



DOUBLE ACTING CYLINDERS

RAM NO.	CYLINDER CODE NO.	EFFECT. AREA	MAX. PSI PUSH	TONS PUSH	MAX. PSI PULL	TONS PULL
RA800-2	CD-1509-75-00	1.862 1.0936	5300	5	5500	3
R945	CD-1515-75-00	1.862 1.101	5300	5	5500	3
RA810-1	CD-2009-57-01	3.267 1.5365	7300	12	5200	4
RT910	CD-2009-57-02	3.267 1.5365	7300	12	5200	4
R947	CD-2022-56-00	3.267 1.5365	7300	12	5200	4
R444	CD-2607-52-00	5.1573 4.3719	2900	5	2000	3
R551	CD-2610-52-00	5.1573 2.9208	2000	5	2000	3
RA820	CD-2609-55-00	5.1573 2.0646	7750	20	4800	5
RA830	CD-3009-56-00	7.2678 2.4202	6000	22	4900	6
RA698-1	CD-3526-56-00	9.6212 2.6991	7300	35	6000	8

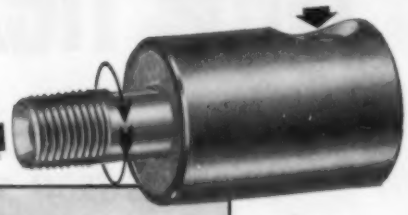
DYNEX, Inc.,
Dept. C-571,
1500 S. Muskego Ave.,
Milwaukee 4, Wis.
is a development of the
HYDRAULIC CONTROL DIVISION
of BLACKHAWK MFG. CO.

BLACKHAWK
HYDRAULIC CONTROLS

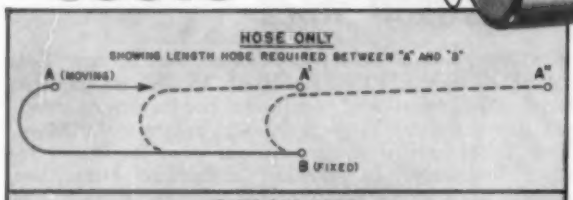
Circle 56 on Reader Service Card

SINGLE PLANE

New Barco SWIVEL JOINTS help cut HOSE COSTS



Straight or Angle Connections



1. Use Shorter Hose Lengths

For Hydraulic or Pneumatic Service

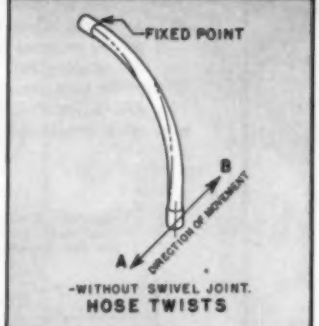
HERE is a real opportunity for product designers and machinery builders to CUT HOSE COSTS. Barco's new Single Plane Swivel Joints are especially suitable for use as *leakproof* flexible connectors (either angle or straight) wherever hose moves, bends, or twists.

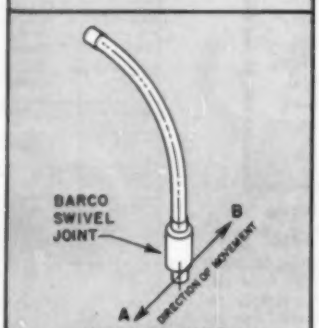
- *Key to Better Engineering!* Often possible to eliminate long radius bends—get neat, space-saving installations (See Fig. 1). Eliminate torsional working stresses that cause fatigue and failure in pressure hose (See Fig. 2).
- *Economical!* These new Barco joints are small, light, and inexpensive. They turn with very low torque under pressure.
- *Sealed, Unitized Construction.* Built with ball-bearing or thrust bearing. O-ring seal. Choice of styles; sizes ¼", ½", ⅜", ¾". For service to 2,000 psi, −20° to 225°F. Other types available for higher ratings.

GET THE FACTS NOW!

For complete information, see our nearest representative, or write. ASK FOR NEW CATALOG SHEET No. 406A.

2. Get Longer Hose Life





BARCO MANUFACTURING CO.

BARCO

532-B Hough Street Barrington, Illinois

In Canada: The Holden Co., Ltd., Montreal

New Products continued

SOLENOID VALVE
. . . uses multi-voltage coil

Features: Permits flow control of 12 common fluids, including air, through 42 different valve styles and capacities, with any one of 7 electrical circuits. Insulated magnet wire is heavily impregnated with

varnish and entire coil is oven-baked for maximum moisture resistance and heat dissipation. Temperature rise of less than half the allowable limit is reported. Valves range from 7/64 to 1½ inch port sizes, suitable for temperatures up to 225 degrees F.

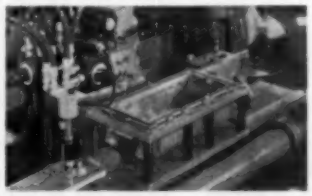
Jackes-Evans Manufacturing Co. St. Louis, Mo.

Circle 222 on Reader Service Card

TRACER CONTROL SYSTEM
. . . is magnetic sensing type

Designation: Hydro-Magnetic Tracer

Features: Unit is magnetic sensing type stylus automatically producing a closed two dimensional or 360 degree contour. Operator is only

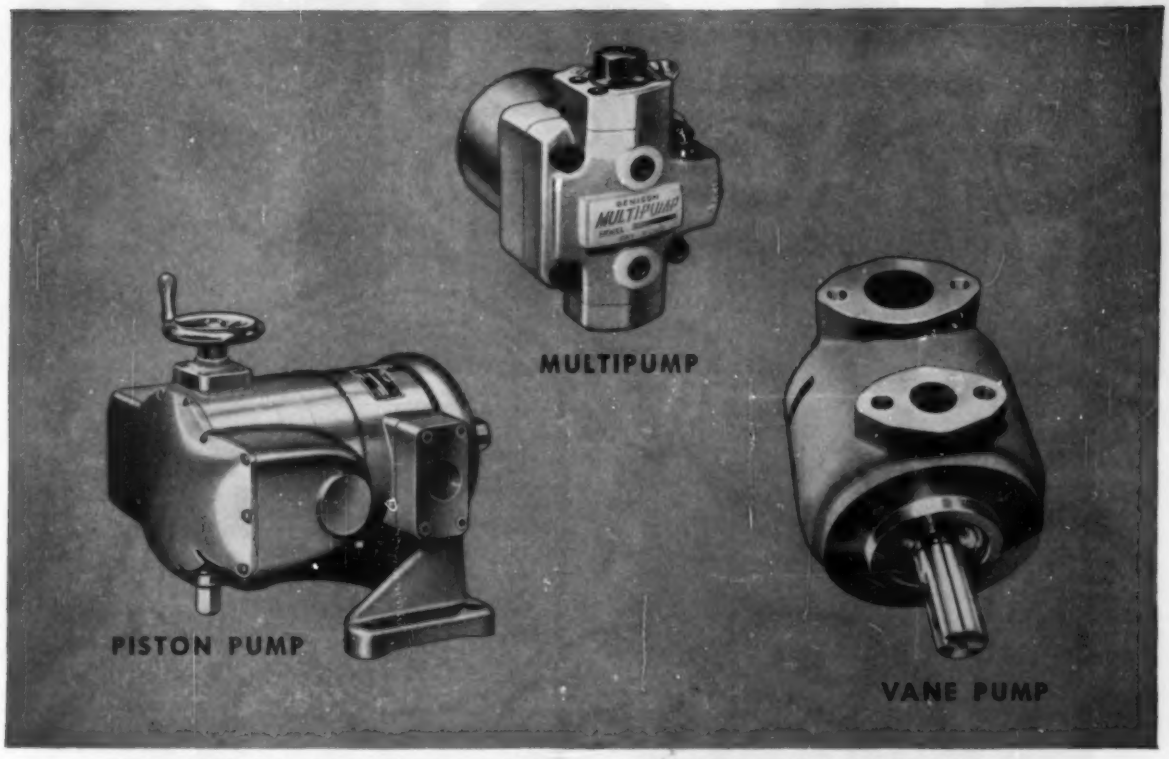


required to predetermine maximum feed rates. Tracer valve is equipped with built-in selector enabling operator to use valve as an automatic 360 degree pencil type tracer control.

Turchan Follower Machine Co. Detroit, Mich.

Circle 223 on Reader Service Card

Continued on page 73



Compact Axial Piston Type Denison Pumps feature fewer moving parts. Thrust bearings have been eliminated. Fixed or variable stroke models are available in sizes 10, 20 and 35 gpm. New variable volume vane *Denison Multipump* offers variable volume at constant speed plus constant volume at variable speed.

For performance, economy, safety... fire-resistant Pydraul in Denison Pumps

Here's a good formula for trouble-free hydraulic operation: A rugged Denison pump... and highly stable Pydraul hydraulic fluid for amazing lubricity. Not only will you have less system maintenance and down time, you'll have an hydraulic operation that's fire safe.

Pydraul lubricates like petroleum oil, has a longer service life than most other fluids and is reclaimable. You can return spillage to the system . . . use it again and again. So in addition to being fire-resistant, Pydraul can actually save you money on fluid consumption.

If your hydraulic equipment is near hot metal, electrical contacts, open flame or other heat sources, you might be taking a needless fire risk. Your Monsanto representative will show you how easy and economical it is to convert to a fire-safe Pydraul system.

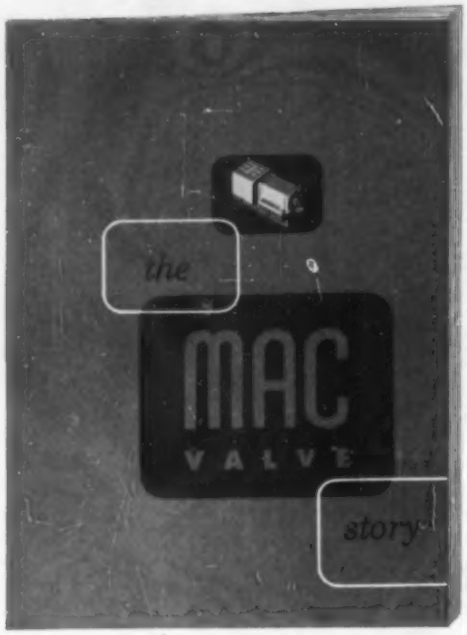
Pydraul F-9—first and only hydraulic fluid listed by Underwriters' Laboratories

"In respect to fire hazard, Pydraul F-9 is rated by Underwriters' Laboratories, Inc., 2 to 3 in a class much less flammable than paraffin (Petroleum) oil, according to a schedule in which Ether is rated 100; Gasoline 90—100; Alcohol (ethyl) 60—70; Kerosene 30—40; Paraffin oil, 10—20."

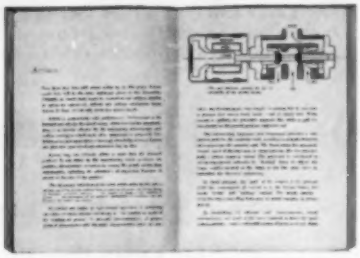
Pydraul: Reg. U. S. Pat. Off.

Write for FREE Pydraul F-9 booklet...
Organic Chemicals Division
MONSANTO CHEMICAL COMPANY
Dept. OEM-8, St. Louis 1, Missouri

FACTS



Basic Principles



Form, Structure, Action

...about air valves!

Mechanical Air Controls, Inc.
10030 Capital, Oak Park, Detroit 37, Michigan

Gentlemen:
Please rush me a free copy of "The MAC Valve Story".

Name_____

Title_____

Company_____

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Clear, concise and fundamental describe "The MAC Valve Story."

Nontechnical throughout, its 28 pages begin with basic air valve principles . . . touch briefly on components and design . . . conclude with simple operation and application.

You'll find much of interest and value in this illustrated booklet—even if you're an expert in air valves. So get your free copy. Send in the coupon at left.

MECHANICAL AIR CONTROLS, INC.
10030 Capital, Oak Park, Detroit 37, Mich.

MAC

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DENVER 16—Blair Engineering Co., 4100 Grape St., FLorida 5-7142

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FLINT—Kober Sales Engineering Co., 514 Beach St., CEdar 8-5123
WESTERN MICHIGAN—Everett Adams, 17212 Sharon Road, Chesaning, Michigan, Chesaning 383-J-1

MINNESOTA
MINNEAPOLIS 4—Air Engineering & Supply Co., 2445 Nicollet Ave., FEderal 9-5579
ST. PAUL 14—W. H. Schulz Co., 2438 Franklin Ave., MIdway 4-2791

MISSOURI
ST. LOUIS COUNTY—Oscar E. Jost Co., P. O. Box 6, St. Ann, HArrison 8-4488

NEW JERSEY (Northern)
CRANFORD—The Roden Company, P. O. Box 305, BRidge 6-7330

NEW YORK
BUFFALO 21—C. H. Tepas Co., 200 Washington Hwy., Circle 3210

OHIO
CINCINNATI—The R. W. Nichols Co., Fidelity Federal Savings Bldg., 2087-9 Sherman Ave., Norwood, ELmhurst 1-2440
DAYTON—The R. W. Nichols Co., 407 Realty Bldg., Michigan 4724
OLMSTED FALLS—The R. W. Nichols Co., P. O. Box 6, ADams 5-3366
TOLEDO 14—The R. W. Nichols Co., 510 Manhattan Building, CHerry 1-1447

OREGON
PORTLAND—The Rucker Co., 911 N. W. Hoyt St., CApitol 3-0205

PENNSYLVANIA
PHILADELPHIA—Grand Air-Hydro Co., P.O. Box 141, Glenside, TUrner 7-4296
PITTSBURGH 22—The R. W. Nichols Co., 101 Investment Bldg., ATlantic 1-6050

TEXAS
DALLAS 19—Womack Machine Supply Co., Shea Rd. at 7150 Harry Hines, FLeetwood 7-3871

WASHINGTON
SEATTLE—The Rucker Co., 1000 4th Ave., South, MAin 2783

WISCONSIN
MILWAUKEE 17—Neff Engineering Co., 5856 N. Pt. Washington Rd., EDgewood 2-1579

MECHANICAL AIR CONTROLS, INC.
DETROIT 37, MICHIGAN
MAC

New Products

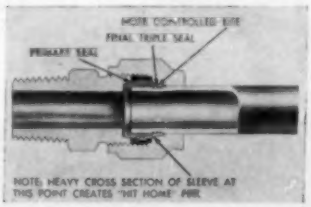
continued

FLARELESS TUBE FITTING
. . . permits closer bends

Designation: Hi-Seal

Features: Designed for full range of pressure conditions. Butt-tight joint is formed so tubing need not be sprung when making assemblies. Shoulder on sleeve prevents incorrect assembly. Three serrated edges on sleeve bite radially into tube surface to a controlled depth, making a triple seal. It will not move longitudinally in assembly, scrape or shave tubing, and there is no torquing of tube when making a joint.

Specifications: Fitting consists of a body, nut and alloy steel sleeve, available in steel or stainless steel in a variety of sizes. Conforms to JIC standards and ASME code for



pressure piping. Designed and built to remain pressure-tight beyond burst strength of the tube. Furnished with long Dryseal pipe threads or with straight threads with O-ring seal.

Imperial Brass Manufacturing Co.
Chicago, Ill.

Circle 224 on Reader Service Card

RUBBER COMPOUND
. . . gives quick break-away

Designation: Compound No. 1318

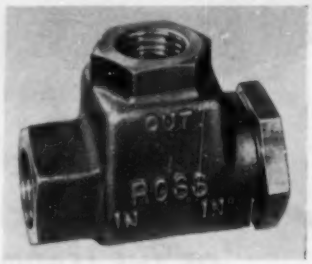
Features: Material has outstanding non-sticking properties gives quick break-away without lubrication. Compound should be ideal for valve seat and other aplications, with excellent bonding-to-metal properties. Recommended temperature range is from —40 to 300 degrees F.

Goshen Rubber Co., Inc.
Goshen, Ind.

Circle 225 on Reader Service Card

SHUTTLE VALVE
. . . weighs only 14 ounces

Features: Valve has differential sealing pressure of 15 psi and operating pressure of 15 to 125 psi. Temperature range is up to 175 degrees F.



Specifications: Offered in ¼ and ⅜ inch pipe sizes, with envelope of 1-¼ inches and 2-⅜ inches long. The brass unit having two inlets and one outlet is used in pneumatic circuitry.

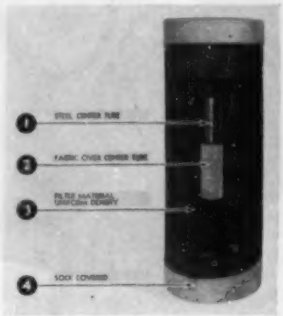
Ross Operating Valve Co.
Detroit, Mich.

Circle 226 on Reader Service Card

NEW FILTER MATERIAL
. . . for fine filtration

Designation: Tuflite

Features: Consists of graded cotton fibers felted into sheets and impregnated with a thermo-setting plastic resin not soluable in oil or



water. Designed for high flow rate and low pressure drop while removing particles down to 5 microns. Assembly is rigid to avoid sagging and shrinking.

The Hilliard Corporation
Elmira, N. Y.

Circle 227 on Reader Service Card

For more NEW PRODUCTS reviews turn to page 238

Vogt

DROP FORGED STEEL VALVES and FITTINGS

Modern die casting machine operation involves the use of standard hydraulic oils as well as special non-inflammable oils which must be safely and positively controlled at pressures from 800 pounds up to 4000 pounds per square inch.

Vogt drop forged steel valves, fittings, flanges and unions are unsurpassed for these rigorous duties and are standard equipment on the leading makes of die casting machines.

Consult Catalog F-9 for the complete line of Drop Forged Steel Valves, Fittings and Flanges.

"FIRST CHOICE OF THE LEADING MAKERS OF DIE CASTING MACHINES"

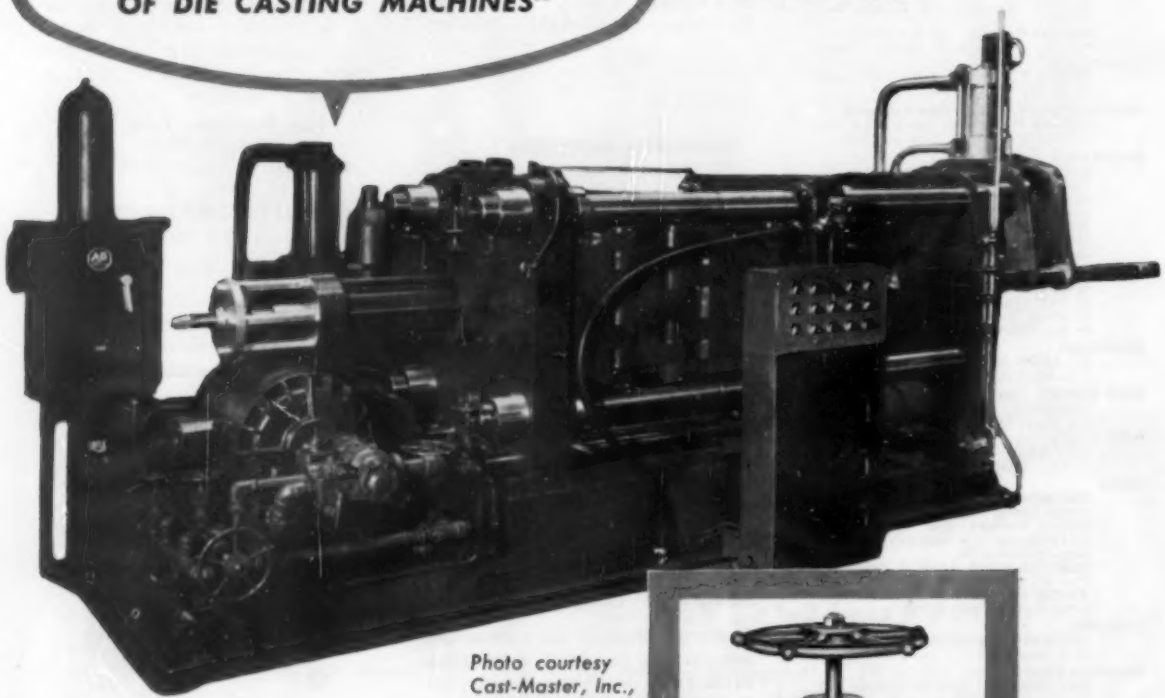


Photo courtesy Cast-Master, Inc., Cleveland, Ohio

HENRY VOGT MACHINE CO.
P.O. Box 1918
Louisville 1, Kentucky

SALES OFFICES:
New York, Chicago, Cleveland, Dallas, Philadelphia
St. Louis, Charleston, W. Va., Cincinnati

OTHER VOGT PRODUCTS
Drop Forged Steel Valves, Fittings and Flanges in a complete range of sizes • Petroleum Refinery and Chemical Plant Equipment • Steam Generators • Heat Exchangers • Ice Making & Refrigerating Equipment

PERFORMANCE

O-M Tie-rodless (round line) Air and Hydraulic Cylinders rated to 500 psi Air; to 1500 psi Hydraulic.

O-M

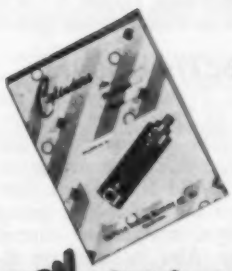
• SMOOTH • POWERFUL • DEPENDABLE

CYLINDERS
TIE-RODLESS

air and hydraulic meet JIC standards

O-M Tie-rodless Air and Hydraulic Cylinders deliver peak performance at low or high speeds. They are simple and unique in design . . . have no tie rods or projecting end caps . . . fit easily in unusually close quarters . . . operate with lowest co-efficient of friction . . . and are readily disassembled for servicing. Besides, the ports can be oriented to any position. Interchangeable mounts make O-M Cylinders adaptable to any installation. All cylinders tested at rated operating pressures before shipment.

Available in full range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods.



mail coupon now!

for Bulletin 101A, showing all cylinders, mounts and mounting brackets.

ORTMAN-MILLER MACHINE COMPANY
1143 Street, Hammond, Indiana

☐ Have Representative call ☐ Send Bulletin 101A (Round Line)

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Company_____
Address_____
City_____ Zone____ State_____

Circle 133 on Reader Service Card

Useful Literature

For your free copy of publications reviewed, fill in the reader service card

HYDRAULIC PUMPS . . . variable delivery type, manufactured by New York Air Brake Company's Watertown Division, are designed to simplify aircraft hydraulic systems. Pumps meet military specifications and incorporate integral automatic pressure and flow regulation. Piston actuating mechanism is not affected by pressure or temperature. Available range of models covers 2 to 10 gpm at 1500 rpm with operating pressures to 3000 psi and speeds to 4500 rpm. Bulletin 501 gives specifications and illustrations.

Circle 265 on Reader Service Card

CHECK VALVES . . . for 3000 psi service, controllable, rotary type are manufactured by Aircraft Products Company's Tactair Valve Division. Units conform to MS-28880 and exceed MIL-V-5528 specifications. They are designed for heavy duty hydraulic service, but are economical enough for all-purpose shut-off use. Data Sheet Series 5900 gives flow data charts, dimension tables, complete specifications and operation information.

Circle 266 on Reader Service Card

AIR & OIL CYLINDERS . . . for 250 psi air, 500 psi hydraulic service, are produced by Alkon Products Corporation. Bulletin gives description and specifications on the various models and mountings available. Units exceed JIC standards.

Circle 267 on Reader Service Card

PRESSURE REDUCING VALVES . . . and relief valves, as used in hydraulic circuits to simplify plastics molding operations, are discussed in brochure released by Atlas Valve Company. Contents of brochure MMR-56 relate directly to plastics molding, but apply to any industry where simplified hydraulic pressure reducing hookups are desirable.

Circle 268 on Reader Service Card

SWIVEL JOINTS . . . aircraft-type, for hydraulic and pneumatic service, are illustrated and described in catalog 269-A published by Barco Manufacturing Company. Bulletin gives details on 360-degree plane swivel and self-aligning type providing 360-degrees rotation plus 15-degree side flexibility. Available in flared and flareless connections for pressures to 4000 psi.

Circle 269 on Reader Service Card

ELECTRIC MOTORS . . . for all types of service are manufactured by Sterling Electric Motors, Inc. Their condensed catalog gives pricing, dimensional and technical data on most commonly used types of electrical motor drives.

Circle 270 on Reader Service Card

DRY COIL SERVO VALVE . . . for use in aircraft and missile control systems is detailed in brochure released by Hydraulic Research & Mfg. Co. Unit features dry coil torque motor, symmetrical hydraulic amplifier, unitized power stage control and triple filtration. Bulletin gives data on construction and operation.

Circle 271 on Reader Service Card

ROTARY GEAR PUMPS . . . for hydraulic applications are described in catalog "Northern Nitralloy Pumps" released by Northern Ordnance Incorporated. Pump sizes range from ¼ gpm to 146 gpm, for service up to 2000 psi. Catalog gives complete design, performance and engineering information on the units, and includes general engineering information on viscosities and pipe velocities and sizes.

Circle 272 on Reader Service Card

SYNTHETIC ELASTOMER . . . for use with hydraulic fluids . . . offering solvent-resistance . . . is discussed in the Vyram bulletin offered by Monsanto Chemical Company's Organic Chemicals Division. Detailed immersion data is given, including various solvents, immersion time, temperature and volume increase, and change in hardness, tensile strength and elongation. List of suppliers of the material is also included.

Circle 273 on Reader Service Card

IN-LINE RELIEF VALVES . . . for airborne service, are described in bulletin A-5212 released by Vickers Incorporated. Important characteristics of the valves are discussed and construction features are illustrated with cutaway drawing. Also included are typical test performance curve and installation drawings with dimensions for all models.

Circle 274 on Reader Service Card

RECIPROCATING PUMPS . . . with 3, 5, 7 and 9 plungers are described in Data Sheet 100 released by The Aldrich Pump Co. Complete specifications are given on 25 to 2400 hp direct flow pumps, and the Power-Savr pump with stepless, straight-line control of capacity. Also included are dimension tables and pump selection chart for quick reference.

Circle 275 on Reader Service Card

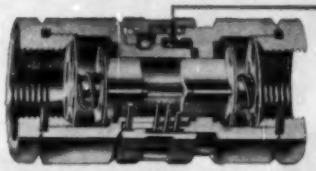
Continued on page 78

WHICH SNAP-TITE QUICK-CONNECT COUPLING IS BEST FOR YOU?

SNAP-TITE "H" COUPLING . . . . . FOR HIGH PRESSURE APPLICATIONS

FOR HYDRAULIC OR AIR

"H" Coupling for high strength, higher efficiency, high-resistance to heavy line surge. Sizes: ⅛" thru 12". Bulletin No. 240

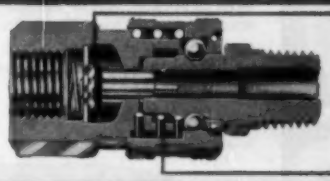


Exclusive U-packer gives a positive seal without compression set because of rubber distortion. Line pressure inside the U-packer keeps it open and forced against its metal backing—the higher the pressure, the tighter the seal.

SNAP-TITE HI-FLOW COUPLING . . . FOR LOW PRESSURE APPLICATIONS

FOR AIR AND FLUIDS UP TO 150 p.s.i.

Hi-Flow is recommended to connect small air tools to plant air system, and for low pressure fluid transfer in small lines. Sizes: ⅛" thru ¾". Bulletin No. 230

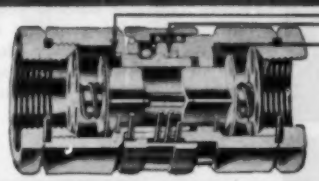


Bonded valve washer
(pat. pending on valve construction)

Exclusive U-packer

SNAP-TITE "HK" COUPLING . . . . . FOR HARD TO HANDLE FLUIDS

FOR FUMING ACIDS, ALKALIES, SOLVENTS, AND HIGH PRESSURE STEAM . . . "HK" is the only coupling now on the market for fluid temperatures from —100° F to +500° F . . . and for live steam up to 460° F. Its seals are made of Teflon for which there is no known solvent. Sizes: ¼" thru 3". Bulletin No. 270



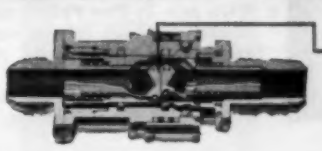
Teflon Valve Seal

Teflon Nipple Seal

Teflon Valve Seal

SNAP-TITE NO-SPILL COUPLING . . . FOR MINIMUM AIR INCLUSION

FOR AIRCRAFT, MISSILE HYDRAULIC, FUEL SYSTEMS which cannot stand air in the lines, and for transmitting fluids which *must not spill*, the Snap-Tite no-spill coupling is recommended. Bulletin No. 280

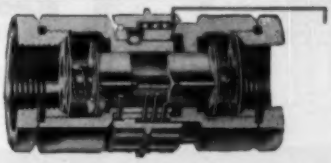


Flush valves prevent spillage, air inclusion. Snap-Tite will engineer special variations to your requirements.

SNAP-TITE "E" COUPLING . . . . . FOR VACUUM and VERY LOW PRESSURE

FOR VACUUM SYSTEMS IN THE MICRON RANGE

"E" Coupling performs in the *micron* range in the smaller sizes both connected and disconnected. Recommended, too, for gravity flow . . . U.L. approved for LP Gas. Sizes: ⅛" thru 12". Bulletin No. 250



Nipple seals in coupler by depressing the lip of the E packer and slightly compressing the body of the packer. This new E-packer gives positive seal under high-pressure, low-pressure, and vacuum.

Snap-Tite Couplings are available plain, (without valves), and with either single or double shut-off. Couplings normally furnished in alloy steel, but all (except hi-flow) are also available in brass, aluminum, or stainless steel with a variety of finishes.

SNAP-TITE, INC., UNION CITY 1, PA.

Snap-Tite

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See us at Booth 1721 at the Plant Maintenance Show

NOW . . .

high efficiency

Filters, Regulators, and Lubricators
for Air Supply to Pneumatic Equipment

with the NEW

WATTS **high efficiency** LINE

consisting of:

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high efficiency
FILTER

New TORNADO ACTION

Contoured inlet eliminates drastic air pressure drop and forces the air into a downward spiral. This "Tornado Action" sets up centrifugal force which spirals dirt and moisture particles downward into the "quiet zone."

WATTS
high efficiency
REGULATOR

New ASPIRATOR ACTION

Watts Aspirator control acts directly on input valve, giving instant compensation for fluctuating pressure demands . . . provides precise control and stabilizes pressures reaching individual pieces of equipment.

WATTS
high efficiency
LUBRICATOR

New BY-PASS PICKUP

Watts new By-Pass Pickup makes possible an exclusive high velocity venturi section which vaporizes virtually 100% of the metered oil. By-Pass permits maintenance of constant pressure in the venturi section with minimum pressure loss.

Complete range of Sizes: 1/4", 3/8", 1/2"

BOWLS CAN BE REMOVED IN 30 SECONDS

Write for catalog and specification sheets on WATTS high efficiency line.

WATTS REGULATOR COMPANY
SINCE 1875

8 EMBANKMENT ROAD LAWRENCE, MASSACHUSETTS

Useful Literature / continued

FLUID PRESSURE CELLS . . . converting pressure changes directly into electrical charges, are produced by Baldwin-Lima-Hamilton's Electronics and Instrumentation Division. Bulletin 4306 gives illustrations and specifications on the types available and discusses operation, characteristics and instrumentation.

Circle 276 on Reader Service Card

HYDRAULIC SYSTEMS . . . for turbo-jet and turboprop aircraft engines, are discussed in 8-page bulletin A5211 released by Vickers Incorporated. Entitled "Vickers Looks Ahead to the New Engines", bulletin describes basic control requirements for turbo-jet and turbo prop engines and outlines today's engine problem in terms of thrust, Mach number, temperature, altitude and life for engine accessories. Also included is a brief discussion and illustration of a jet engine simulator.

Circle 277 on Reader Service Card

SHEAVE . . . with new one and two-groove "Magi-Key" feature offers simple, inexpensive variation of speeds. Bulletin 20B8524, released by Allis-Chalmers Manufacturing Company, illustrates procedure of changing adjustment and gives complete specifications and dimensions. New keylock gives design horsepower capacity up to 13 hp.

Circle 278 on Reader Service Card

ELECTRIC RELAYS . . . for industrial control applications are illustrated and described in Automatic Electric Sales Corporation's Circular 1702-D. Specifications are given on relays for various applications and service requirements, including hermetically sealed models.

Circle 279 on Reader Service Card

HYDRAULIC PUMPS, CYLINDERS . . . and other components manufactured by Char-Lynn Company are described in their booklet "Hydraulic Horsepower". Principles of hydraulics are given in clear, interesting illustrations. Details and

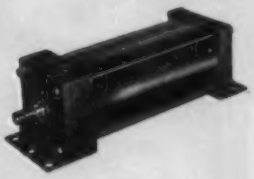
Continued on page 81

RIVETT FURNISHES A

complete POWER PACKAGE!

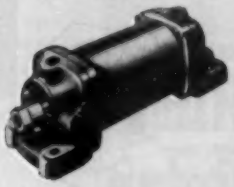
Get all your air and hydraulic needs from one source!
Over 500 standard models in all sizes for immediate delivery!

AIR CYLINDERS—168 Models



TIE ROD DESIGN

150 P.S.I. air; 250, 350, 500 P.S.I. oil. 8 mountings; 10 bore diameters; single or double end rod; internal or external thread; cushioning. J.I.C. Special covers. See Catalog 10.



KEEPER RING DESIGN

150 P.S.I. air; 300 P.S.I. oil. 7 mountings; 9 bore diameters; single or double end rod; internal or external thread; cushioning. Special covers. See Catalog 55.

HYDRAULIC VALVES—200 Models

Panel Mounted
Pipe Mounted
Direct Control
Functional

Pipe Mounted Foot

Panel Mounted Solenoid

1500 and 3000 P.S.I. Standard, spring-return, spring-centered, ball detent. All piston designs. Hand, foot, cam, solenoid, solenoid pilot, oil pilot, air pilot. ¼", ⅜", ½", ¾", 1", 1¼", 1½", 2". See Catalog 204.

Panel valves conform to J.I.C. Greater flow; low pressure; shock resistant. Interchangeable sizes. See Catalog 261.

AIR VALVES—47 Models

Hand

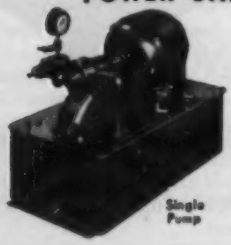
150 P.S.I. 3 and 4-way. Hand, foot, cam, solenoid, and pilot. ¼", ⅜", ½", ¾" and 1". Pilot valves in side and foot mountings—palm, push-button, cam, foot, solenoid operation. See Catalog 303.

HYDRAULIC CYLINDERS—108 Models

Keeper Ring

300 and 1500 P.S.I.; 3000 P.S.I. furnished. 7 mountings; 10 bore diameters; standard and 2:1 over-size rod: single and double end rods, internal or external thread; cushioning. Special covers. See Catalog 106.

POWER UNITS—17 Models



Single Pump

1000 and 1500 P.S.I. Single pumps in six tank sizes. Capacities .4 to 40 G.P.M. Double pumps in four tank sizes with combined capacities 3.5 to 80 G.P.M.

CUSTOM-BUILT

Pressures to 5000 P.S.I. For unusual space, size, piping, valving, mounting, operation. See Catalog 400.

HANDY AIDS FOR AIR & HYDRAULIC CIRCUITS!

90 pages of working drawings, specifications, cut-away views. Get Free Copies Today!

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The Better You Like

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Guarantee TOP Performance and Maximum Life!

Specify THESE TOP QUALITY FEATURES...

(Standard on Miller Cylinders at no extra cost)

Specify CASE HARDENED CHROME PLATED PISTON RODS
On all Air and Hydraulic Cylinders

Benefits To You

CASE-HARDENED Piston Rods (52-54 Rockwell "C") provide practically complete protection against damage from hammer blows, wrench-dropping, mishandling, and similar occurrences. ***Available from Miller at no extra cost.***

The HARD CHROME PLATING over the case-hardened rods protects against scratch-damage and rust. ***Available from Miller at no extra cost.***

Specify "TEFLON" WIPERS
On all Air and Hydraulic Cylinders

Benefits To You

"TEFLON" Rod Wipers and "TEFLON" Hydraulic Piston Rod Seals withstand temperatures from—100°F. to plus 500°F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use. ***Available from Miller at no extra cost.***

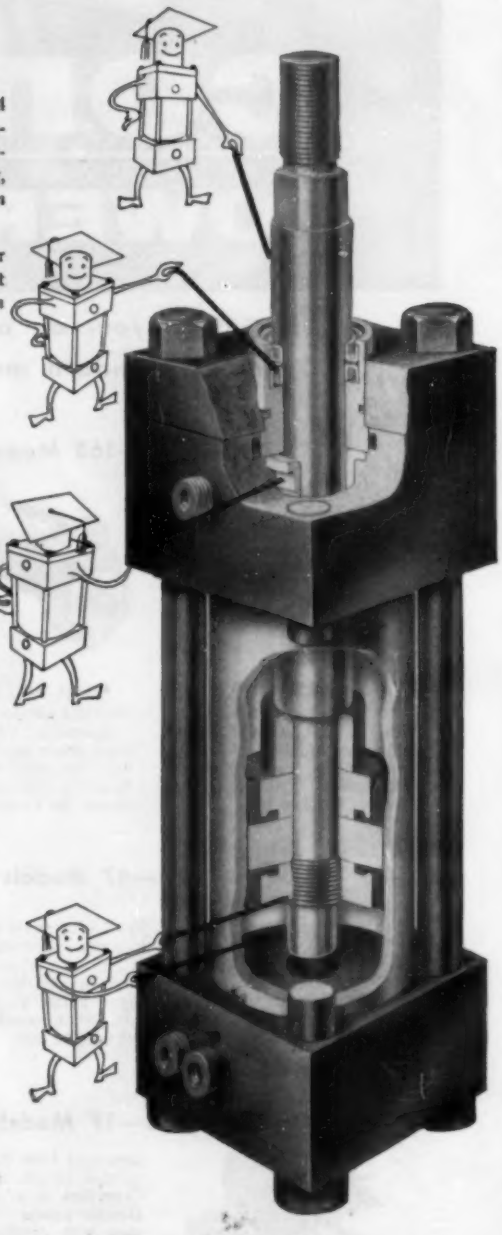
Specify TEFLON HYDRAULIC ROD SEALS
On all Hydraulic Cylinders

Specify RUST RESISTANT SURFACES
On all Air and Hydraulic Cylinders

Benefits To You

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods have this finish ***at no extra cost on all Miller cylinders.*** (This finish not recommended for water service)



NOTE. On all Miller Hydraulic Piston Seals: Leather Cup Seals are *standard,* Piston Ring Seals are optional at *no extra cost,* and "Teflon" Cup Seals are available *at extra cost.*

You may wish to route this entire page to the proper department in your company, by using this handy form. Additional copies on request. →

To (Dept.)_____

"On all our future cylinder requirements, please specify the above quality features."

Signed_____

Title_____

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MILLER FLUID POWER DIVISION FLICK-REEDY CORP.

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AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

specifications are covered for their line of power packs, pumps, reservoirs, control valves, couplers, filters and cylinders. Also included are graphs showing load capacity, cylinder speed, volume, stroke, plumbing size, horsepower required and pump size.

Circle 280 on Reader Service Card

FLEXIBLE CHAIN COUPLINGS . . . are described and illustrated in revised catalog C45-56 released by Morse Chain Company. Specifications, dimensions, ratings and applications are given on silent and roller chain couplings. Also included is general information explaining purpose and function of flexible chain couplings. Major application of interest to fluid power field is coupling of pumps and compressors to prime mover.

Circle 281 on Reader Service Card

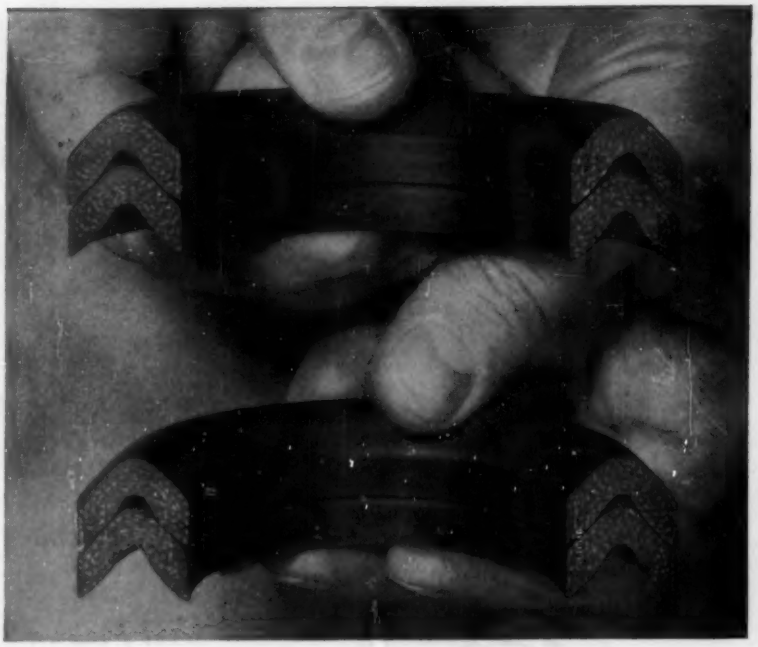
SPEED-FEED METER . . . electronically measuring rates of machine carriage and table feeds and spindle speeds of any machine tool are produced by Maico Co., Inc. Large indicator scale gives reading instantly, continuously, accurately . . . no further calculations required. Bulletin 1140 gives specifications and description of 6 models available. Easily installed on any machine, speeds as low as 0.25 and as high as 125 inches per minute are accurately indicated.

Circle 282 on Reader Service Card

METAL HOSE & TUBING . . . for pneumatic and hydraulic service is described in 64-page catalog G-560 published by The American Brass Company's American Metal Hose Division. Helpful design suggestions are given for flexible metal connector applications, including hose and tubing specifications, construction diagrams and descriptions of end fittings.

Circle 283 on Reader Service Card

For more reviews of FREE LITERATURE turn to page 258



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Appearance won't tell—performance will!

DESIGNED FOR EVERY PISTON AND ROD • ROCK-HARD RINGS • POLYMER SATURATED FABRIC • PRECISION TRIMMING • PROPER INTERFERENCE FOR AUTOMATIC SEALING

R/M Vee-Flex is so designed as to be self-sealing and self-adjusting. The surfaces of the rings have a convex curvature where they contact the ring adjacent. The hydraulic pressure stroke produces a seal laterally against the stuffing box wall and longitudinally against the next ring.

Deep, thorough penetration of the compound into the fabric of this top-flight packing enables it to provide maximum resistance to extrusion at high pressures. In addition, it is precision molded for better fit, longer service. Whatever your hydraulic application, you can count on R/M Vee-Flex for perfect performance.

R/M makes a complete line of mechanical packings, including Vee-Flex, Vee-Square, Homogeneous Vee-Rings, and Fabric Piston Cups

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RAYBESTOS-MANHATTAN, INC.
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Circle 147 on Reader Service Card

1957 FLUID POWER PRIZE PAPER CONTEST

for

Articles About: Pneumatic and Hydraulic Systems and Components

DESIGN • APPLICATION • MAINTENANCE

5th Annual Competition

First Prize *$500*

Second Prize *$300*

Third Prize *$200*

4th to 7th Prizes, each *$50*

All prize papers will be published in APPLIED HYDRAULICS Magazine. Papers receiving honorable mention awards will also be published during 1958 and paid for at regular rates.

CONTEST CLOSES JULY 1, 1957

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812 HURON ROAD

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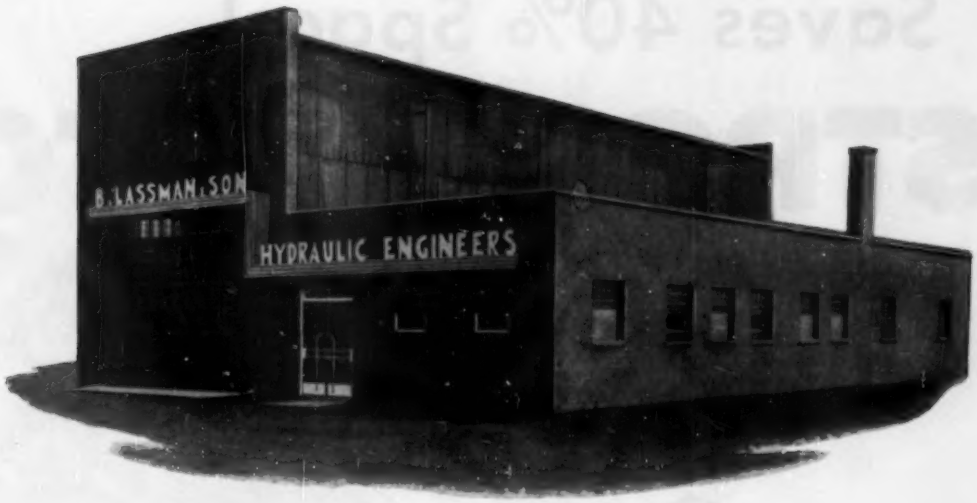
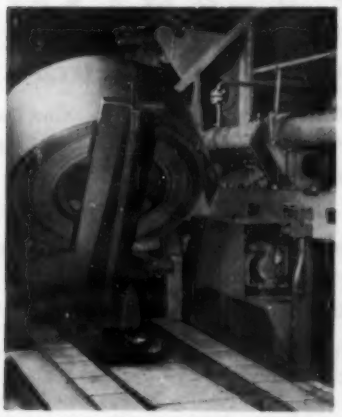


This is Benjamin Lassman & Son

For over 37 years, we have specialized in the design and manufacture of heavy duty hydraulic equipment. We have become recognized for our different approach to the engineering analysis of hydraulic circuits resulting in almost unbelievable system simplicity, and for the quality of our equipment which provides the ultimate in uninterrupted, reliable performance.

As a result of this, we have done and are presently doing the more difficult and unusual in the field of industrial hydraulics . . . operations such as pouring molten metal, dumping railroad cars, providing rapid and shock-free performance on high tonnage presses, and supplying special components. All of these applications involve equipment that we have designed and built.



Let us show you how Lassman engineering and quality hydraulic equipment is your guarantee of continuous, trouble-free operation.

Typical of our re-evaluation of a relatively standard application of hydraulic power is this Downender, where we are able to provide higher speeds with greater smoothness of motion than had previously been thought possible . . . particularly in accelerating and decelerating the coiled strip during downending.

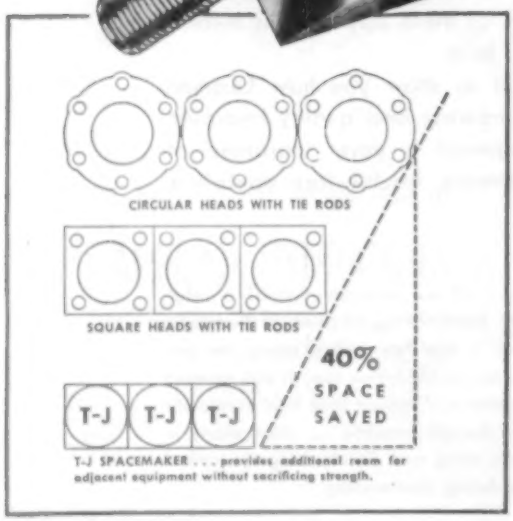
Quality EQUIPMENT for *Quality* PERFORMANCE

BENJAMIN LASSMAN & SON Route 8, GLENSHAW, PA.

Saves 40% Space!

STRONGER, TOO

Than Outmoded Tie Rod Cylinders!


CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
40% SPACE SAVED
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T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

NEW LITERATURE . . . send today for new Bulletin with complete details of Spacemaker line.

Only T-J Spacemaker CYLINDERS

Offer All The Extras As Standard!

- **NEW *exclusive* Ingenious Cushion Designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion**
- **Compact design eliminates tie rods, saves up to 40% space**
- **Proven Performance . . . with Extra High Safety Factor**
- **Hard Chrome Plated Bodies and Piston Rods (Standard, at no extra cost).**
- **OIL pressure to 750—AIR to 200 P.S.I.**

You'll find many answers to *automation* in your plant with T-J Spacemaker Cylinders! Designed with years-ahead features for top performance and dependability. Wide range of styles, capacities . . . for all kinds of push-pull-lift operations . . . reduces man-hours and costs! Write The Tomkins-Johnson Co., Jackson, Michigan.

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T-J **TOMKINS-JOHNSON**

RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

1957 is . . .

. . . APPLIED HYDRAULICS' Tenth Anniversary Year.

This Designers' Guide Issue that we are herewith presenting to you, marks two milestones in the career of the fluid power industry and APPLIED HYDRAULICS Magazine.

When we conceived the idea of a magazine in the fluid power industry, we were asked, on all sides, "What are you going to put in your second issue?" We knew there was going to be a second issue, because we believed in the future of the fluid power industry. We knew that designers recognized in hydraulics and pneumatics the elements they needed for activating modern-day machinery. We knew that there was a paucity of information on the subject.

We were confronted with a heterogeneous group of manufacturers who never even thought themselves as an "industry". And while the very importance of fluid power has made these individual manufacturers grow to two, three and ten times their former size, we like to feel that APPLIED HYDRAULICS Magazine has played an important part in the growth of an industry as we now know it. This January Designers' Guide attests to the fact that fluid power has come of age and has grown to young manhood.

So we enter our tenth year with even more confidence than we had when we started publishing AH in 1948, because we believe now as then that designers will find many and more efficient uses for hydraulics and pneumatics in the years to come. The Industry will grow, and APPLIED HYDRAULICS Magazine will do its best to be in the van of that growth.

Irving B. Hexter

IRVING B. HEXTER
PUBLISHER

You can assure dependable,

ECONOMICAL HYDRAULIC PERFORMANCE

TAKE a tip from the Midwest plant (name on request) whose presses are shown here. An initial fill of *Texaco Regal Oil R&O* went into these presses when they were installed two years ago. The plant recently reported:

"Your Texaco Regal Oil R&O has done a great job in assuring the dependable hydraulic performance we must have. All systems are completely free of sludge, rust and foam. Very little make-up has been required."

Texaco Regal Oil R&O is tailor-made for hydraulic service. It has *more than ten times the oxidation resistance* of ordinary turbine-grade oils, outstanding ability to keep systems clean and protect vital parts. These superior properties make *Texaco Regal Oil R&O* ideal for smooth operation and effective lubrication.

There is a complete line of *Texaco Regal Oils R&O* for all hydraulic mechanisms, all operating conditions. Let a Texaco Lubrication Engineer help you select the proper ones. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

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TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

Circle 179 on Reader Service Card

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Prepared by the Editors of **Applied Hydraulics** the Magazine of Fluid Power

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ACCUMULATORS

● STANDARD
○ SPECIAL

		USE			PRESSURE RATINGS						TYPE								
												WEIGHTED			HYDROPNEUMATIC				
		INDUSTRIAL	MOBILE	AIRCRAFT	TO 1000 PSI	TO 2000 PSI	TO 3000 PSI	TO 6000 PSI	TO 10,000 PSI	OVER 10,000 PSI	WEIGHTED TANK	CAST IRON	CONCRETE	NON-SEPARATOR	BLADDER	SPHERICAL BAG	DIAPHRAGM	PISTON	SPRING LOADED
	ALDRICH PUMP COMPANY	●			●	●	●				●	●	●					●	●
	JOHN S. BARNES CORP.	●			●										●				
*	CARTER CONTROLS, INC.	●	●															●	●
	DOWTY EQUIPMENT LTD.			●				●											
	DUKES COMPANY			○			●											●	●
	ELECTROL, INC.	○	○	○			●											●	●
*	FAWCETT-FINNEY LTD. A METAL INDUSTRIES GROUP CO.	●	●	●	●		●	●			●	●	●		●				
*	FLUID CONTROLS, INC.		●		●	●	●												●
*	GREER INDUSTRIES, INC.	●	●	●				●				●			●	●			
	HIGH PRESSURE EQUIPMENT	●	●						●	●	●							●	
	HOUDAILLE AVIATION			○	●	●	●							●				●	●
	HYDRAMOTIVE, INC.	●	○			●	●											●	
*	BENJAMIN LASSMAN & SON	●			●						●	●	●						
*	MILLER FLUID POWER DIV. FLICK-REEDY CORPORATION	●				●												●	
*	PARKER APPLIANCE COMPANY	●	●				●											●	
*	PETCH MANUFACTURING CO.	○			●	●	●											●	○
	REDCO TOOL DIVISION RED LION CABINET COMPANY	○	○	●	○	○	●											●	
*	SMITHS JACKING SYSTEMS LTD.	●				●												●	
*	SPRAGUE ENGINEERING CORP.	●	●	●				●	●									●	○
*	SUPERIOR HYDRAULICS DIV. SUPERIOR PIPE SPECIALTIES	●	●					●										●	
	TAVCO, INC.			●			●										●	●	
*	VICKERS, INC. DIVISION OF SPERRY RAND	●		●			●								●	●	●	●	
	VINSON MANUFACTURING CO.			●			●												●
	WESTINGHOUSE AIR BRAKE CO. INDUSTRIAL PRODUCTS DIV.	●			●	●											●		
	R. D. WOOD COMPANY	●						●	○		●	●	●					●	

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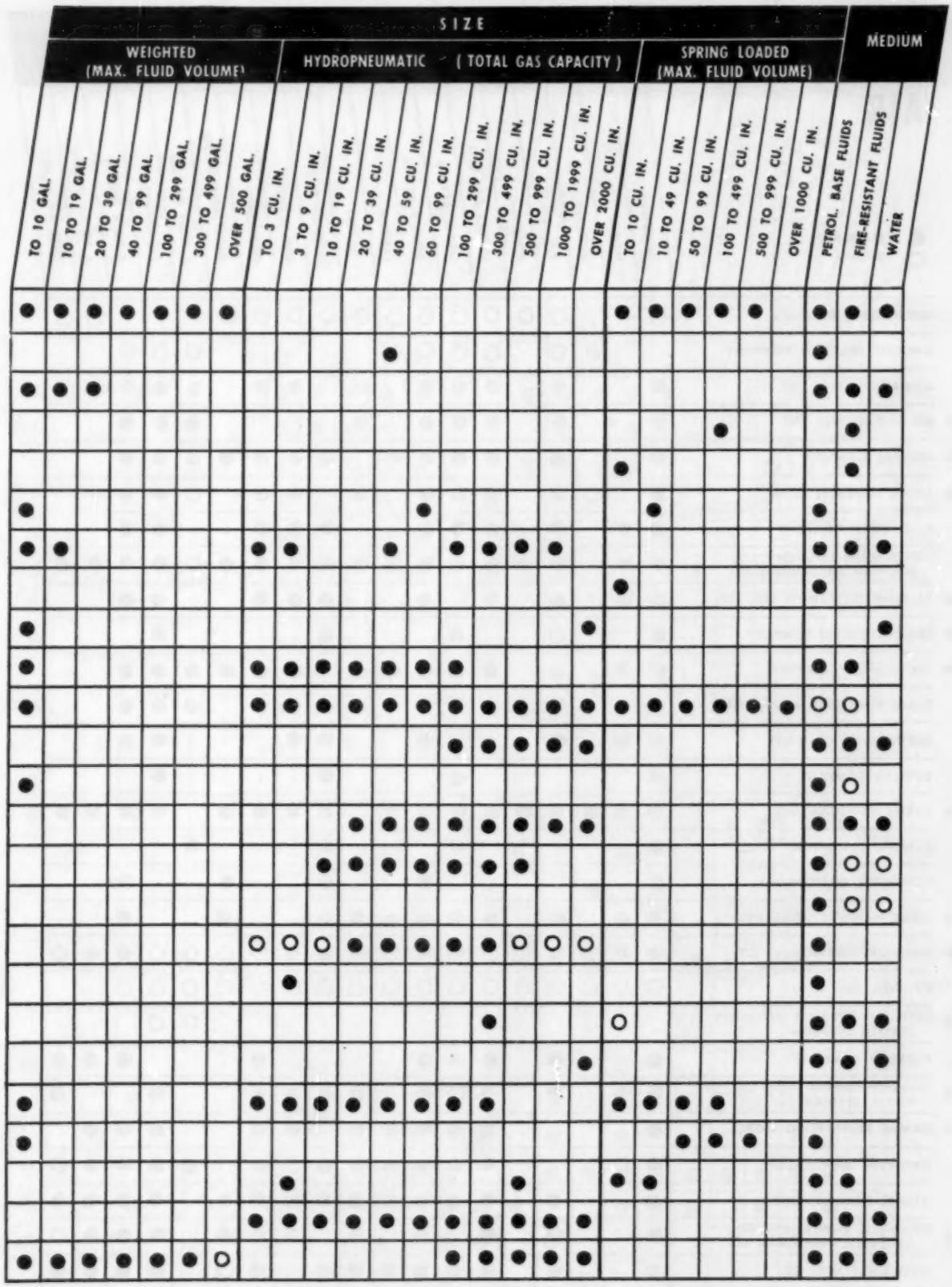

SIZE
WEIGHTED (MAX. FLUID VOLUME)
TO 10 GAL.
10 TO 19 GAL.
20 TO 39 GAL.
40 TO 99 GAL.
100 TO 299 GAL.
300 TO 499 GAL.
OVER 500 GAL.
HYDROPNEUMATIC (TOTAL GAS CAPACITY)
TO 3 CU. IN.
3 TO 9 CU. IN.
10 TO 19 CU. IN.
20 TO 39 CU. IN.
40 TO 59 CU. IN.
60 TO 99 CU. IN.
100 TO 299 CU. IN.
300 TO 499 CU. IN.
500 TO 999 CU. IN.
1000 TO 1999 CU. IN.
OVER 2000 CU. IN.
SPRING LOADED (MAX. FLUID VOLUME)
TO 10 CU. IN.
10 TO 49 CU. IN.
50 TO 99 CU. IN.
100 TO 499 CU. IN.
500 TO 999 CU. IN.
OVER 1000 CU. IN.
MEDIUM
PETROL. BASE FLUIDS
FIRE-RESISTANT FLUIDS
WATER

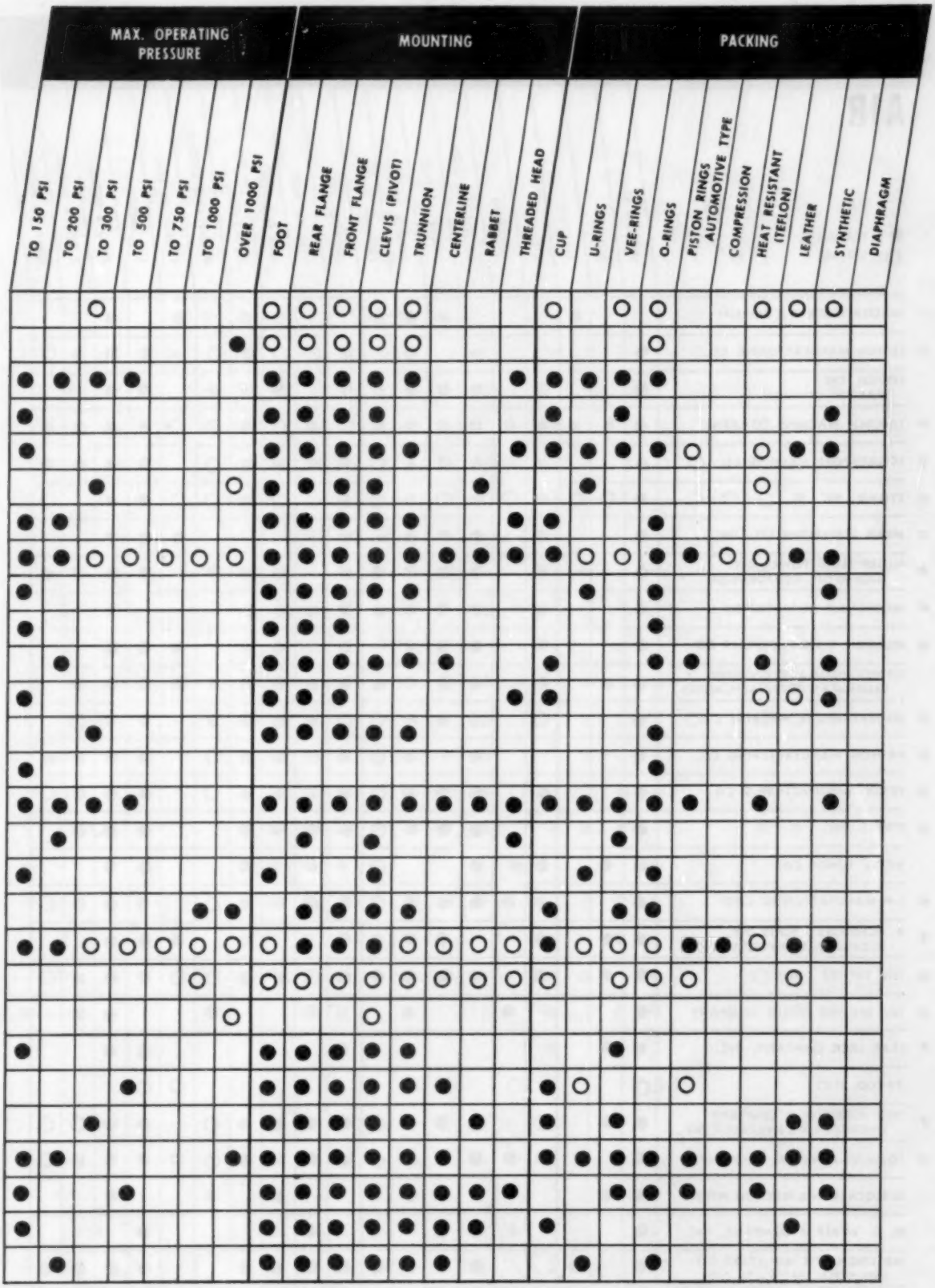
CYLINDERS, AIR

● STANDARD
○ SPECIAL

		USE				TYPES						FEATURES					BORE				
		INDUSTRIAL	MOBILE	AIRCRAFT	AIR - OIL	ROTATING	DOUBLE-END ROD	SINGLE ACTING	DOUBLE ACTING	TANDEM	TIE ROD	NON TIE ROD	ROD SCRAPER	CUSHIONED	ADJUSTABLE STROKE	1 INCH OR LESS	1½ INCHES	2 TO 8 INCHES	8 TO 14 INCHES	OVER 14 INCHES
	ADVANCED HYDRAULICS	○			○	○	○	○	○	○	○	○	○	○	○				○	○
	AIRCRAFT PRODUCTS COMPANY			●	○		○	○	○	○						○	○	○		
	AIRMATIC VALVES, INC.	●			●		●	●	●		●		●	●		●	●	●		
*	AIR-MITE DEVICES, INC.	●			●		●	●	●		●					●	●	●		
*	AIROYAL COMPANY	●			●		●	●	●	●		●	●	●	●	●	●	●		
*	ALKON PRODUCTS CORP.	●		○	●		●	●	●		●		●	●		○	●	●		
	A. K. ALLEN COMPANY	●	●		●		●	●	●			●	●	●			●	●		
	ANKER-HOLTH DIVISION WELLMAN ENGINEERING CO.	●	●		●	●	●	●	●	●	●	●	●	●	●	○	●	●	●	●
*	BALDWIN INSTRUMENT CO., LTD.	●	●		●		●		●			●	●	●			●	●		
*	BECKETT-HARCUM COMPANY	●			○			●				●					●			
*	THE BELLOWS COMPANY	●	●		●		●	●	●	●	●		●	●	●	●	●	●		
	BIMBA HARDWARE & MFG. CO.	●			●			●	●		●	●	●	●		●	●	●		
	THE BRUNING COMPANY	●	●		●				●			●	●				●	●		
	BURKLYN COMPANY	●						●				●					●			
*	CARTER CONTROLS, INC.	●	●	●	●	●	●	●	●	●		●	●	●	●		●	●	●	●
	CLIPPARD INSTRUMENT LAB.	●						●				●				●				
	CONOFLOW CORPORATION	●							●			●			●			●		
*	CROSS MANUFACTURING CO.	●	●		●		●	●	●	●	●	●			●			●		
*	DENSMORE ENGINEERING CO.	●	●	○	●	○	○	●	●	○	●	●	●	○	○	○	○	●	●	○
	ELECTROL, INC.	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
*	FAIRCHILD ENGINE & APPLIANCE STRATOS DIVISION			○												○	○			
	FOXBORO COMPANY	●			●		●	●	●				●					●	●	●
*	GALLAND-HENNING MFG. CO. NOPAK DIVISION	●	●		●		●	○	●		●	●	●	●			●			●
*	HANNA ENGINEERING WORKS	●					●	●	●	●	●		●	●			●	●	●	
	HANNIFIN CORPORATION	●	○				●	●	●	●	●	●	○	●		●	●	●	●	○
	HYDAIR CYLINDER CORP.	●			●		●	●	●	●	●	●	●	●	●		●	●	●	●
*	HYDRAULIC POWER DIVISION HYDRAULIC PRESS MFG. CO.	●			●		●		●		●		●	●	●		●	●	●	○
	HYDRO-LINE MFG. CO.	●			●		●	●	●	●	●	●		●	○		●	●	●	●

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



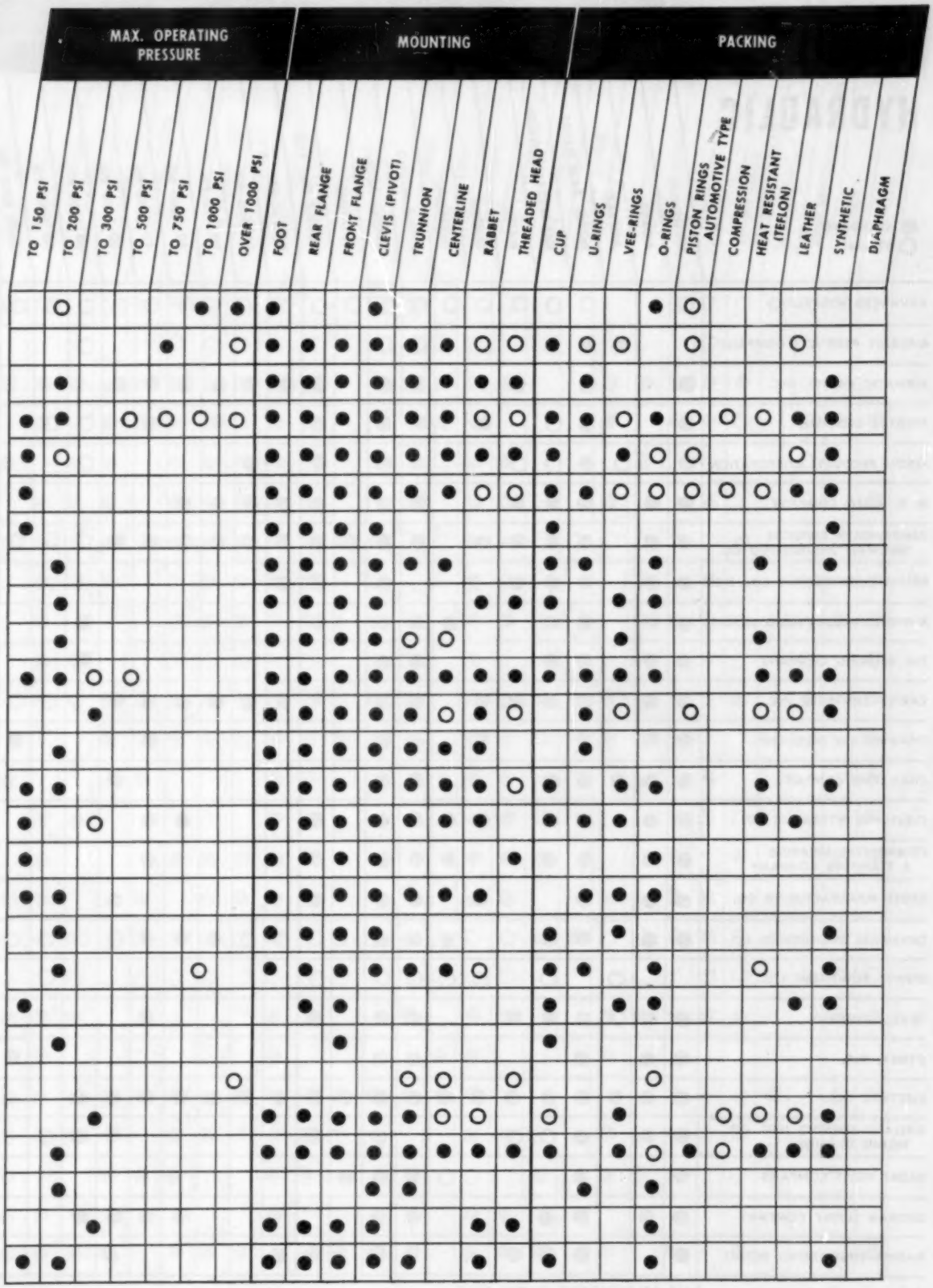
CYLINDERS, AIR

● STANDARD
○ SPECIAL

		USE				TYPES							FEATURES					BORE				
		INDUSTRIAL	MOBILE	AIRCRAFT	AIR - OIL	ROTATING	DOUBLE-END ROD	SINGLE ACTING	DOUBLE ACTING	TANDEM	TIE ROD	NON TIE ROD	ROD SCRAPER	CUSHIONED	ADJUSTABLE STROKE	1 INCH OR LESS	1½ INCHES	2 TO 8 INCHES	8 TO 14 INCHES	OVER 14 INCHES
	WALTER KIDDE & COMPANY			●				●	●					●		●		●		
*	LEDEEN MANUFACTURING CO.	●			○		●		●		●	○	○	●	○		●	●	●	○
	LEHIGH, INC. MARTON DIVISION	●			●		●	●	●	●	●		●	●	●		●	●		
*	LINCOLN MACHINE COMPANY	●	●	●	●	●	●	●	●	●	○	●	○	●	○	○	●	●	●	●
*	LOGANSPORT MACHINE CO.	●			●	●	●	●	●	○	●	●	●	●	○		●	●	●	●
*	LYNAIR, INC.	●	○	○	●	○	●	○	●	○	●	○	○	●	○	○	●	●		○
*	MEAD SPECIALTIES CO., INC.	●			●		●	●	●		●					●	●	●		
*	MILLER FLUID POWER DIV. FLICK-REEDY CORPORATION	●			●		●	●	●	●	●		●	●	●		●	●	●	●
*	MODERNAIR CORPORATION	●			●		●	●	●	●	●	●	●	●				●		
*	MUNTON MANUFACTURING CO.	●			●		●	●	●		●		●	●		●	●	●		
	ORTHO-PNEUMATIC DIVISION LAURENCE'S ORTHO APPLIANCES	●	●		●		●	●	●	●	●	●	●	●	●	●	●	●	●	
*	ORTMAN-MILLER MACHINE CO.	●			○		●	●	●	○	○	●	●	●	●		●	●	○	
*	PATHON MANUFACTURING CO.	●					●		●	○	●	●	●	●	○		●	●	●	●
*	PETCH MANUFACTURING CO.	●			●		●	●	●	○	●	●	●	●	○		●	●	●	○
*	RIVETT, INC.	●					●	●	●	○	●	●	●	●			●	●	●	
	ROTEX PUNCH CO.	●	●		●		●			○		●		●			●	●		
*	S-P MANUFACTURING CORP.	●			●	●	●	●	●	○	●	●	●	●	○		●	●	●	○
*	A. SCHRADER'S SONS DIV. SCOVILL MANUFACTURING CO.	●	●		●			●	●		●			●		●	●	●		
*	THE SHEFFER CORP.	●	●		●		●	●	●	●	●	○	●	●	○	○	●	●	●	○
*	THE SKINNER CHUCK COMPANY	●				●			●			●			●			●	●	
*	STAR JACK COMPANY, INC.	●	●						●								●	●		
	TAVCO, INC.	○						○	○							○	○			
*	TEER-WICKWIRE & COMPANY LINDBERG AIR & HYDRAULIC DIV.	●	●		○		○	●	●	○	●	●	●	●	○		●	●	○	○
*	TOMKINS-JOHNSON COMPANY	●			●	●	●	●	●	○	●	●	●	●	○	●	●	●	●	○
	TURLOCK IRON & MACHINE WORKS	●	●					●	●				●		●			●		
	H. G. WEBER & COMPANY, INC.	●					●	●				●					●			
	WESTINGHOUSE AIR BRAKE CO. INDUSTRIAL PRODUCTS DIV.	●		●			●	●	●	●	●	●	●	●			●	●	●	●

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



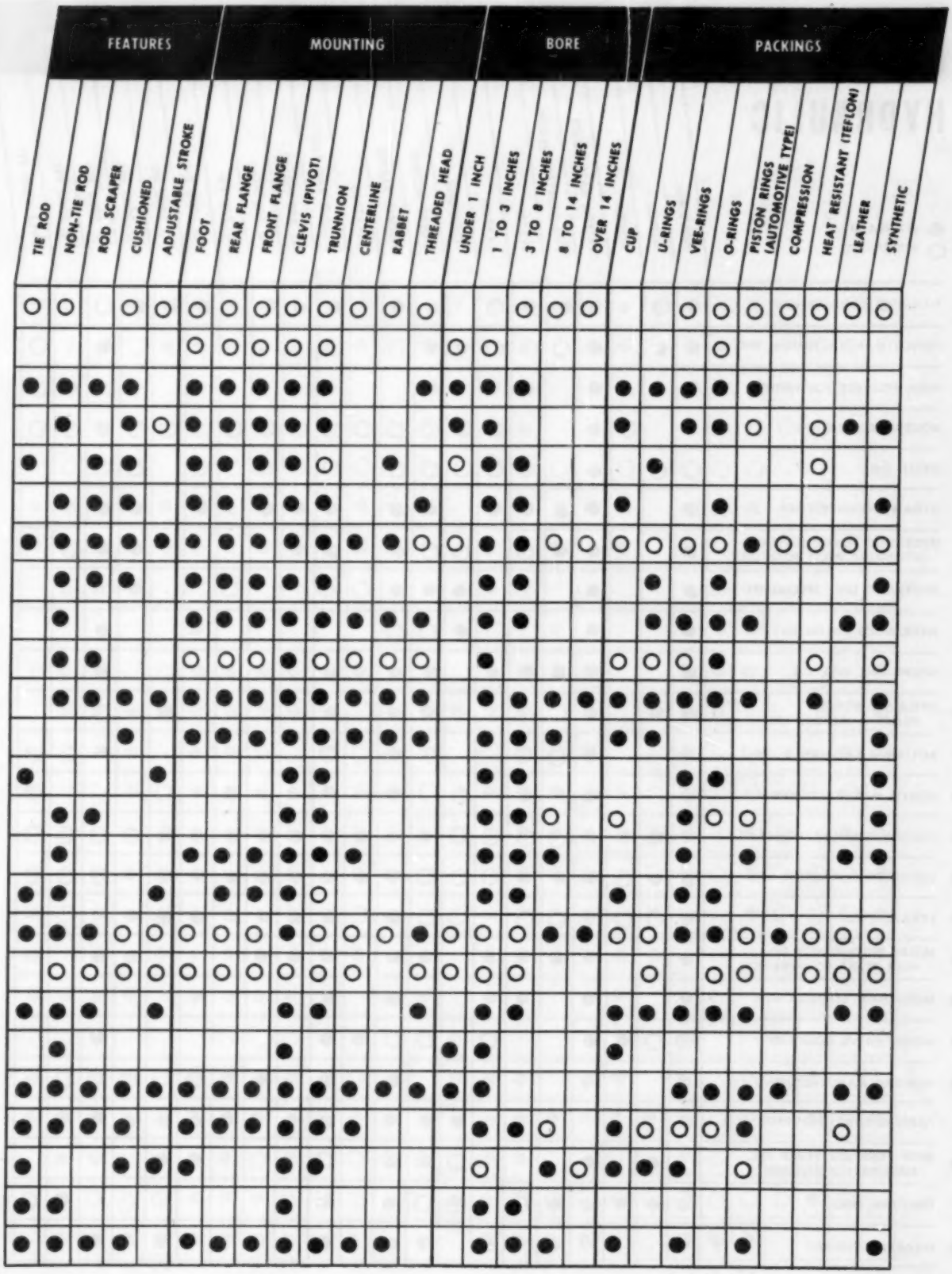
CYLINDERS, HYDRAULIC

● STANDARD
○ SPECIAL

		USE			MEDIUM			TYPES						MAX. OPERATING PRESSURE								
		INDUSTRIAL	MOBILE	AIRCRAFT	PETROL BASE FLUIDS	FIRE-RESISTANT FLUIDS	WATER	TANDEM	TELESCOPIC	SINGLE ACTING	DOUBLE ACTING	ROTATING	DOUBLE END ROD	TO 250 PSI	TO 500 PSI	TO 750 PSI	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	TO 3000 PSI	TO 5000 PSI	OVER 5000 PSI
	ADVANCED HYDRAULICS	○			○	○	○	○	○	○	○	○	○				○	○	○	○	○	○
	AIRCRAFT PRODUCTS COMPANY			●	●			○		○	○		○							○		
	AIRMATIC VALVES, INC.	●			●		●			●	●		●	●	●	●	●	●	●			
*	AIROYAL COMPANY	●			●	○		●		●	●		●			●		●		○	○	
*	ALKON PRODUCTS CORPORATION	●		○	●	○	○			●	●		●		●					○		
	A. K. ALLEN COMPANY	●	●		●	●	●			●	●		●	●	●	●	●					
	ANKER-HOLTH DIVISION WELLMAN ENGINEERING CO.	●	●		●	●	●	●		●	●	●	●	●	●	●	●	●	●	○	○	○
*	BALDWIN INSTRUMENT CO., LTD.	●	●		●	●	●				●		●	●								
*	BENTON HARBOR ENGR'G. WORKS	●	●		●	●			●	●	●		●							●		
	THE BRUNING COMPANY	●	●		●	●				●	●									●		
*	CARTER CONTROLS, INC.	●	●	○	●	●	●	●		●	●		●	●	●	●	●	●	●		○	○
	CHAMBERLAIN INDUSTRIES	●	●		●			●		●	●							●				●
*	CHAR-LYNN COMPANY	●	●	●	●	●				●	●								●			
	CLEVELAND HYDRAULIC CO.	●	●		●	●		○	●	●	●		●				●	●				
*	COMMERCIAL SHEARING & STAMPING COMPANY	●	●		●	●			●	●	●		●					●				
*	CROSS MANUFACTURING CO.	●	●		●			●		●	●		●						●			
*	DENSMORE ENGINEERING CO.	●	●		●	●			●	●	●		○	○	○	●	●	●	○	○	○	○
	DOWTY EQUIPMENT LTD.			○		○		○	○	○	○		○								○	
	DUKES COMPANY	●	●	○	●	●	●			●	●		●					●				
*	DYNEX, INC.	●	●		●					●	●											●
	ELECTROL, INC.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
*	GALLAND-HENNING MFG. CO. NOPAK DIVISION	●	●		●	○	○				●		●						●	●	○	
	GLOBE HOIST COMPANY	●			●				○	●	●	●										
	GROBAN SUPPLY COMPANY	●	●		●	●				●	●						●	●	●	●		
*	HANNA ENGINEERING WORKS	●			●	●	●			●	●		●	●					●			

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



CYLINDERS, HYDRAULIC

● STANDARD
○ SPECIAL

		USE			MEDIUM				TYPES						MAX. OPERATING PRESSURE								
		INDUSTRIAL	MOBILE	AIRCRAFT	PETROL. BASE FLUIDS	FIRE-RESISTANT FLUIDS	WATER	TANDEM	TELESCOPIC	SINGLE ACTING	DOUBLE ACTING	ROTATING	DOUBLE END ROD	TO 250 PSI	TO 500 PSI	TO 750 PSI	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	TO 3000 PSI	TO 5000 PSI	OVER 5000 PSI
	HANNIFIN CORPORATION	●	○		●	●	●	○		●	●		●	●	●		●	●	●	○		
	HEMCO MANUFACTURING, INC.	●	●		●	○	○	○	●	●			○							●		○
	HIGH PRESSURE EQUIPMENT	●			●		●			●											●	○
	HOUDAILLE AVIATION			○	●			○	○	○	○	○	○	○	○	○	○	○	○	●	○	○
	HYCO, INC.	○	○		●			○	○	○	○		○						○			
	HYDAIR CYLINDER CORP.	●			●	●	●	●		●	●		●	●	●		●		●	●		
*	HYDRAULIC POWER DIVISION HYDRAULIC PRESS MFG. CO.	●			●	●	○		○	○	●		●	●					●	●	○	
	HYDRAULIC UNIT SPECIALTIES	●			●				●	●	●								●			
	HYDRAULICS UNLIMITED	●			●				●	○	○									●		
	HYDRO-LINE MFG. CO.	●			●	●	●	●		●	●		●							●		
*	KEELAVITE ROTARY PUMPS & MOTORS LTD.	●	●		●	○				●	●		●					●		○		
*	BENJAMIN LASSMAN & SON	●			●	○	○			●	●		○							●	○	○
*	LEDEEN MANUFACTURING CO.	●			●	●	●		○		●		●			●						○
*	LINCOLN MACHINE COMPANY	●	●	●	●	○	○	○	○	●	●	●	●	●	●	●	●	●	○	○	○	○
*	LOGANSPORT MACHINE CO.	●	●	○	●	●	●	○	○	○	●	●	●	●	●	●	●	●	●	○	○	○
*	LYNAIR, INC.	●	○	○	●	○	○			○	●		●	●	●	●	●	●	●			
*	MILLER FLUID POWER DIV. FLICK-REEDY CORPORATION	●			●	●	●	●		●	●		●	●	●				●	●		
*	MODERNAIR CORPORATION	●			●		●	●			●		●				●					
*	MOOG VALVE COMPANY	○	○	●	●			○		○	○	●	●							●		
*	MUNTON MANUFACTURING CO.	●			●						●		●		●		○	○	○	○	○	
	NEPTUNE POWER PLUS PRODS. CO.	●							●	●	●		●	●	●	●	●	●	●	●	●	
*	NEW YORK AIR BRAKE CO. KALAMAZOO DIVISION		●		●				○	●	●		○				●	●				
	OIL-DYNE, INC.	●	●	●	●	●	○		○	○	●		●								●	○
*	OILGEAR COMPANY	●			●	●		●		●	●		●					●		●		

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*

FEATURES						MOUNTING								BORE					PACKINGS								
TIE ROD	NON-TIE ROD	ROD SCRAPER	CUSHIONED	ADJUSTABLE STROKE	FOOT	REAR FLANGE	FRONT FLANGE	CLEVIS (PIVOT)	TRUNNION	CENTERLINE	RABBET	THREADED HEAD	UNDER 1 INCH	1 TO 3 INCHES	3 TO 8 INCHES	8 TO 14 INCHES	OVER 14 INCHES	CUP	U-RINGS	VEE-RINGS	O-RINGS	PISTON RINGS (AUTOMOTIVE TYPE)	COMPRESSION	HEAT RESISTANT (TEFLON)	LEATHER	SYNTHETIC
●	●	○	●		●	●	●	●	●	●				●	●	○	○	●	●	●	●	●		●	●	●
	●	●	○	●	●	●	●	●	●	●	○	○			●		○	●		●	●			○	○	○
					●				●				●	●	●							●					
○	●	○	○	○	○	○	○	○	○	○	○	○	●	●	●							●	○	○	○		○
	○	○	○		○	○	○	○	○	○		○		○	○	○		○		○	○	○					○
●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●			●	○	●		●			●
●	●	●	●	●	●	●	●	●	●	●	●			●	●	●	○	●		●		●					
	●	●				○			○	○				●	●					●							●
					●											●					●						
●	●	●		○	●	●	●	●	●	●				●	●	●				●	●	●					●
	●	●	●	○	●	●	●	●	●				●	●	●				●		●					●
●	●		●		●	●	●	○	●	○	●				●	○	○			●		○			●		○
●	○	○	●	○	●	●	●	●	●	●	○	○		●	●	●	○	●	○	○		○			○		
○	●	○	●	○	●	●	●	●	●	●	○	○	○	●	●	●	●	○	○	●	●	●	○	○	●	●	●
●	●	●	●	○	●	●	●	●	●	●	●	○			●	●	○	●	○	●	○	●		○	○		●
●	○	●	●	○	●	●	●	●	●	○	○	○	○	●	●	○	○	○	●	○		●	○	○	○		●
●		●	●	●	●	●	●	●	●	●				●	●	●		●	●		●	●		●	●		●
●	●	●	●		●	●	●	●			●	●			●			●			●						
					○	○	○	○	○	○	○	○	●	○						●							○
●		●	●		●	●	●	●	○	○			●	●	●			●		●		●		●			
●	●	●	●	●	●	●	●	●	●	●				●	●	●	●	●	●	●		●		●	●	●	●
	●	●			●	●	○	●	○	○	○	○	●	●	○					●						●	●
	●	○	○	○	●	●	●	●	○	○	●		●	●	○	○	○	○	○	○	○	○	○	●	○	○	○
	●	●	●	●	●	●	●	●	●	●				●	●	●	●			●	●	●					

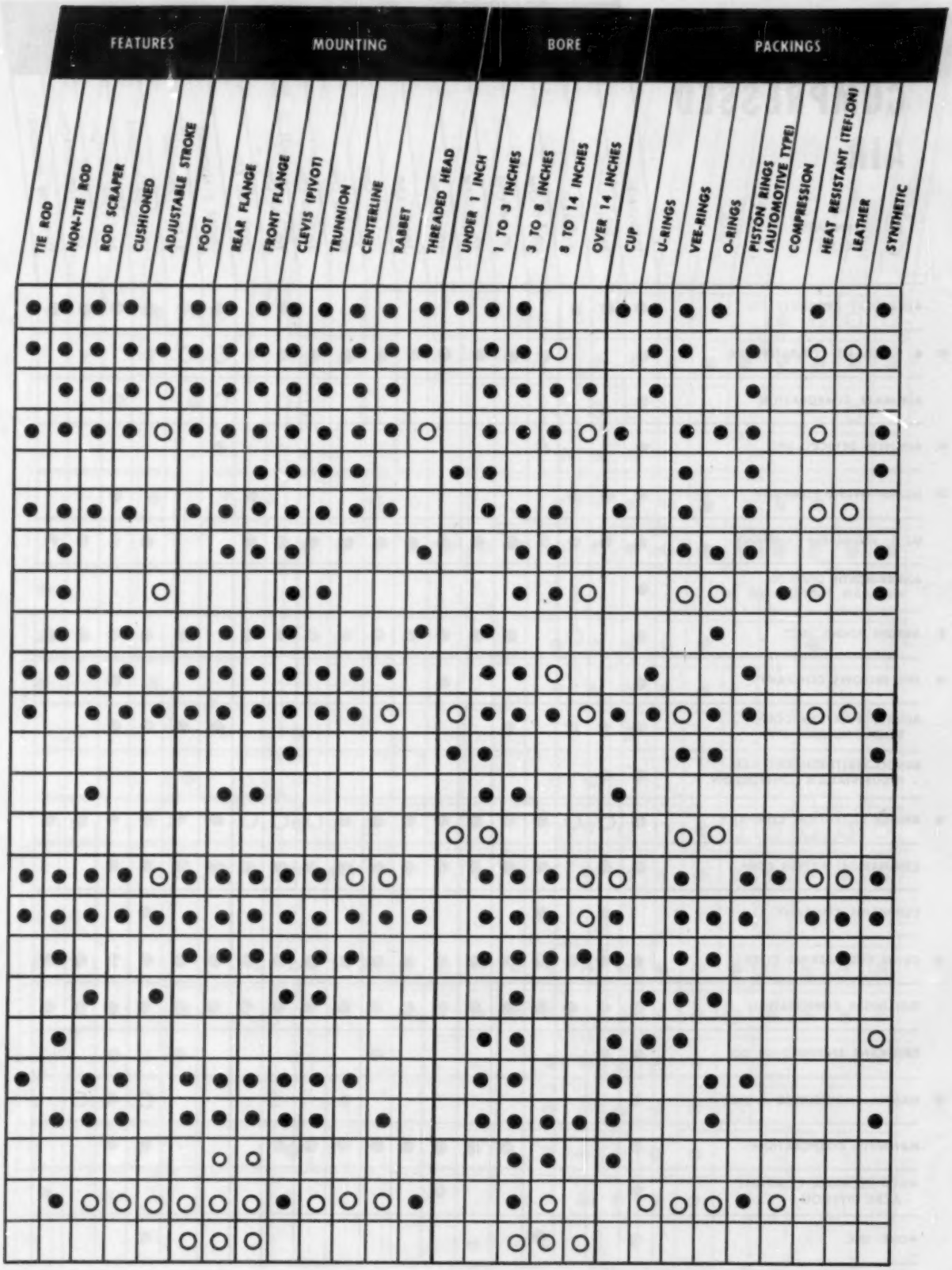
CYLINDERS, HYDRAULIC

● STANDARD
○ SPECIAL

		USE			MEDIUM				TYPES						MAX. OPERATING PRESSURE								
		INDUSTRIAL	MOBILE	AIRCRAFT	PETROL. BASE FLUIDS	FIRE-RESISTANT FLUIDS	WATER	TANDEM	TELESCOPIC	SINGLE ACTING	DOUBLE ACTING	ROTATING	DOUBLE END ROD	TO 250 PSI	TO 500 PSI	TO 750 PSI	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	TO 3000 PSI	TO 5000 PSI	OVER 5000 PSI
	ORTHO-PNEUMATIC DIVISION LAUBENCE'S ORTHO APPLIANCES	●	●		●		●	●		●	●		●		●	●	●	●	●				
*	ORTMAN-MILLER MACHINE CO.	●			●	○	○	○		●	●		●						●	○			
*	PATHON MANUFACTURING CO.	●			●	●	●	○		●	●	○	●	●			●		●	●			
*	PETCH MANUFACTURING CO.	●	●		●	○	○	○	○	●	●		●					●	●	○	○		
*	POWER JACKS LTD.	●			●				●	●	●		●							●			
*	RIVETT, INC.	●			●	●		○		●	●		●					●		○			
	RODGERS HYDRAULICS, INC.	●	●		●	○				●	●										●		
	ROTARY LIFT COMPANY	●	○		●	●			○	●				●			○						
	ROTEX PUNCH COMPANY	●	●		●		●	○			●		●	●									
*	S-P MANUFACTURING CORP.	●			●	●		○		●	●	●	●		●				●				
*	THE SHEFFER CORP.	●	●		●	●	●	○		●	●		●								●	○	
*	SMITHS JACKING SYSTEMS LTD.	●			●					●	●								●				
*	STAR JACK COMPANY, INC.	●	●							●	●		●							●			
	TAVCO, INC.			○	○	○				○	○									○			
*	TEER-WICKWIRE & COMPANY LINDBERG AIR & HYDRAULIC DIV.	●	●		●	○	●	○		●	●		○						●	○			
*	TOMKINS-JOHNSON COMPANY	●			●	●	●				●	●	●					●		○			
	TURCHAN FOLLOWER MACHINE CO.	●			●						●		●				●						
	TURLOCK IRON & MACH. WORKS	●	●		●					●	●		○						●				
	ULRICH MANUFACTURING CO.	●	●		●					●	●								●				
*	VICKERS, INC. DIV. OF SPERRY RAND CORP.	●			●	●					●		●						●				
	WESTINGHOUSE AIR BRAKE CO. INDUSTRIAL PRODUCTS DIV.	●		●	●		●			●	●		●	●									
	K. R. WILSON, INC.	●	●		●					●	●											●	
	WISCONSIN HYDRAULICS, INC.	●	●	●	●	●		○		●	●		○					●					
	R. D. WOOD COMPANY	○			○		○			○	○		○								○		

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



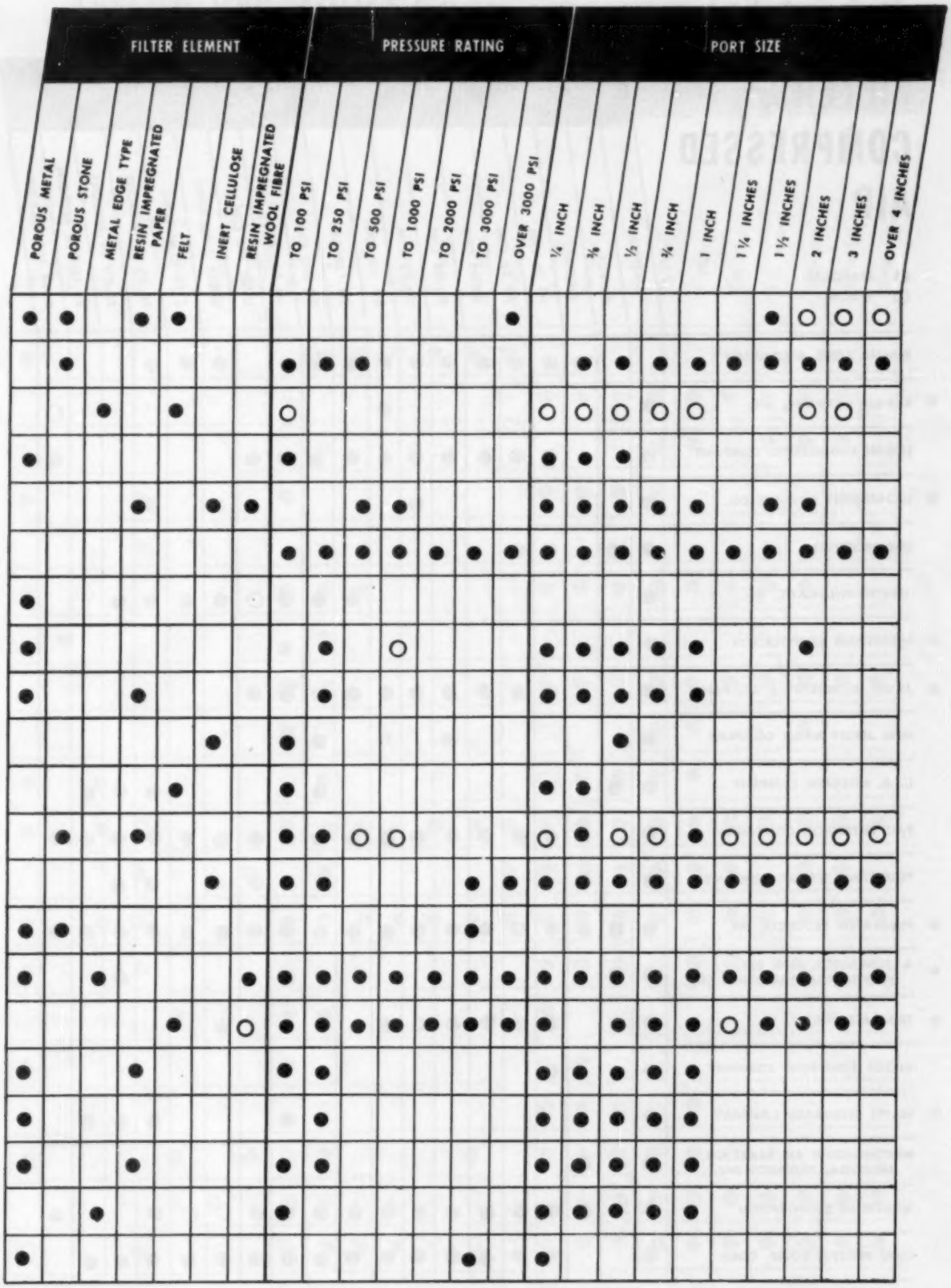
FILTERS, COMPRESSED AIR

● STANDARD
○ SPECIAL

	USE			SIZE, FREE AIR CAPACITY										DEGREE OF FILTRATION					
	INDUSTRIAL	MOBILE	AIRCRAFT	TO 10 CFM	TO 20 CFM	TO 30 CFM	TO 50 CFM	TO 75 CFM	TO 100 CFM	TO 150 CFM	TO 200 CFM	TO 500 CFM	OVER 500 CFM	UNDER 5 MICRONS	5 TO 9 MICRONS	10 TO 24 MICRONS	25 TO 49 MICRONS	50 TO 100 MICRONS	OVER 100 MICRONS
ACCESSORY PRODUCTS CO.	●	●	●									●		●	●	●	●	●	●
* R. P. ADAMS COMPANY, INC.	●			●	●	●	●	●	●	●	●	●	●	○	○	●			
AIR-MAZE CORPORATION	●											○		○			○		
* AIR-MITE DEVICES, INC.	●			●										●					
* ALLIED WITAN COMPANY	●	●	●										●				●		
V. D. ANDERSON COMPANY	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●	●	●
ANKER-HOLTH DIVISION WELLMAN ENGINEERING CO.	●																		
* ARROW TOOLS, INC.	●		○		●	●	●	●	●	●	●	●	●		●	●	●	●	●
* THE BELLOWS COMPANY	●						●										●		
BENDIX AVIATION CORP. BENDIX-SKINNER DIV.	●	●	●		●									●	●	●	●		
BENDIX-WESTINGHOUES AAB INDUSTRIAL AIR CONTROLS DIV.	●	●																	
* BRIGGS FILTRATION COMPANY	●	○	○	●	●	●	●	●	●	●	○	○	○	●	●	●	●	●	●
COMMERCIAL FILTERS CORP.	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●		
CORNELIUS COMPANY		●		●												●			
* CUNO ENGINEERING CORP.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
DOLLINGER CORPORATION	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
GENERANT ENGINEERING CO.	●	●							●						●		●		
* HANNA ENGINEERING WORKS	●									●						○	●	○	
HANNIFIN CORPORATION	●				●	●	●	●	●	●	●	●				●	●		
HILLS McCANNA COMPANY ACRC DIVISION	●						●												●
HOKE, INC.	●			●												●			

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



FILTERS, COMPRESSED AIR

● STANDARD
○ SPECIAL

		USE			SIZE, FREE AIR CAPACITY										DEGREE OF FILTRATION					
		INDUSTRIAL	MOBILE	AIRCRAFT	TO 10 CFM	TO 20 CFM	TO 30 CFM	TO 50 CFM	TO 75 CFM	TO 100 CFM	TO 150 CFM	TO 200 CFM	TO 500 CFM	OVER 500 CFM	UNDER 5 MICRONS	5 TO 9 MICRONS	10 TO 24 MICRONS	25 TO 49 MICRONS	50 TO 100 MICRONS	OVER 100 MICRONS
	WALTER KIDDE & COMPANY			●	●	●	●	●	●	●	●	●	●		●	●	●			
*	KRAISSL COMPANY, INC.	●								●										○
	LOGAN ENGINEERING COMPANY	●			●	●	●	●	●	●	●	●	●	●						●
*	LOGANSPORT MACHINE CO.	●							●								●			
	M-B PRODUCTS	●	●		●	●														
	MASTER PNEUMATIC, INC.	●									●	●	●	○	●	●	●	●		
*	MODERNAIR CORPORATION	●											●							
*	JAMES A. MURPHY & COMPANY	●			●	●	●	●	●	●	●	●	●	●						
	NEW JERSEY METER COMPANY	●						●		●		●								
	C. A. NORGREN COMPANY	●	●									●					●	●	●	
	PALL FILTRATION COMPANIES	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	PERFECTING SERVICE COMPANY	●		●										●			●	●		
*	PUROLATOR PRODUCTS, INC.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
*	A. SCHRADER'S SONS DIV. SCOVILL MANUFACTURING CO.	●	●										●					●		
*	TRU-FLATE, INC.	●	●		●	●	●	●	●	●					●					
	VICTOR EQUIPMENT COMPANY	●			●															
*	WATTS REGULATOR COMPANY	●	●										●				●	●	●	
	WESTINGHOUSE AIR BRAKE CO. INDUSTRIAL PRODUCTS DIV.	●		●																
	WILKERSON CORPORATION	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	●			●
	YORK PROCESS EQUIP. CORP.	●			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*

FILTER ELEMENT								PRESSURE RATING							PORT SIZE									
POROUS METAL	POROUS STONE	METAL EDGE TYPE	RESIN IMPREGNATED PAPER	FELT	INERT CELLULOSE	RESIN IMPREGNATED WOOL FIBRE	TO 100 PSI	TO 250 PSI	TO 500 PSI	TO 1000 PSI	TO 2000 PSI	TO 3000 PSI	OVER 3000 PSI	¼ INCH	⅜ INCH	½ INCH	¾ INCH	1 INCH	1¼ INCHES	1½ INCHES	2 INCHES	3 INCHES	OVER 4 INCHES
●								●	●	●	●	●	●										
							●							●	●	●	●	●	●	●	●	●	
								●									●	●		●	●	●	
●			●				●							●	●	●	●						
			●																				
●							●	●	●					●	●	●	●	●	●	●	●		
	●							●															
							●	●						●	●	●	●	●	●	●	●	●	●
							●	○									●	●			●		
●		●						●						●	●	●	●	●					
●		●					●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
			●	●		●		●					●	●	●	●	●	●	●		●	●	
●		●	●				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
●			●				●							●	●	●	●	●	●				
				●			●	●						●									
●							●							●	●								
●								●						●	●	●	●	●					
●				●		●	●	●				●		●	●	●	●	●	●				
				●	●		●	●	○	○	○	○	○		●	●	●	●	●	●	●	●	●
			●				●	●	●	●	○	○	○	●	●	●	●	●	●	●	●	●	●

FILTERS, HYDRAULIC

● STANDARD
○ SPECIAL

	USE			MEDIUM			MOUNTING			SIZE										
	INDUSTRIAL	MOBILE	AIRCRAFT	PETROLEUM BASE FLUIDS	FIRE-RESISTANT FLUIDS	WATER	LINE TYPE	SUMP TYPE	PORTABLE	TO 5 GPM	5 TO 9 GPM	10 TO 14 GPM	15 TO 24 GPM	25 TO 34 GPM	35 TO 49 GPM	50 TO 74 GPM	75 TO 99 GPM	100 TO 150 GPM	OVER 150 GPM
AIR-MAZE CORPORATION			○				○	○											○
JOHN S. BARNES CORP.	●			●	●		●	●		●	●	●	●	●	●	●				
BENDIX AVIATION CORP. BENDIX-SKINNER DIV.	●	●	●	●	●	●	●			●	●	●	●	●						
* BRIGGS FILTRATION COMPANY	●	●	○	●	●		●	○	●	●	●	●	●	●	●	●	●	●	●	●
* CAPITAL ENGR'G & MFG. CO.	●	●		●				●		●	●	●	●	●	●					
A. W. CASH VALVE MFG. CORP.	●			●		●	●			●										
* CENTURY HYDRAULICS	●			●	●		●													
* CHAR-LYNN COMPANY	●	●	●	●	●	●	●						●							
COMMERCIAL FILTERS CORP.	●	●	●	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●
* CUNO ENGINEERING CORP.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
DOLLINGER CORPORATION	●			●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	○
DOWTY EQUIPMENT LTD.			●		●															
FRAM CORPORATION	○	○	●	●		●	●			●	●	●	●	●	○	○	○			
* S. G. FRANTZ COMPANY, INC.	●		●	●			●	●		●		●	●		●		●	●	●	●
GENERAL FILTERS, INC.	●			●	●		●		●	●	●	●	●	●	●					
* HILLIARD CORPORATION	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
HYDRAMOTIVE, INC.	●	●		●	●		●			●	●	●	●	●	●	●	●	●		
INDIANA COMMERCIAL FILTERS	●	●		●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●
* KEELAVITE ROTARY PUMPS & MOTORS LTD.	●	●		●	●		●	●		●	●	●	●	●	●	●	●	●		
* KRAISSL COMPANY, INC.	●						●	●	●	●	●	●	●	●	●	●	●	●	●	●
* MARVEL ENGINEERING COMPANY	●	●		●	●	●	●	●			●	●	●	●		●	●	●		
MAYHEW PRODUCTS COMPANY	●		●	●	●		●	●	●	●	●	●	●	●	●					
WM. W. NUGENT & COMPANY	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
PALL FILTRATION COMPANIES	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
* PUROLATOR PRODUCTS, INC.	●	●	●				●	●	●	●	●	●	●	●	●	●	●	●	●	●
* SIMPLEX ENGINEERING CORP.	●			●			●					●								
* SPRAGUE ENGINEERING CORP.	●			●	●		●									●				○
* VICKERS, INC. DIVISION OF SPERRY RAND	●		●	●	●		●	●			●		●		●					
VINSON MANUFACTURING CO.			●	●			●			●	●	●								
* WATERMAN ENGINEERING CO.	●	●		●	●	●	●									●				

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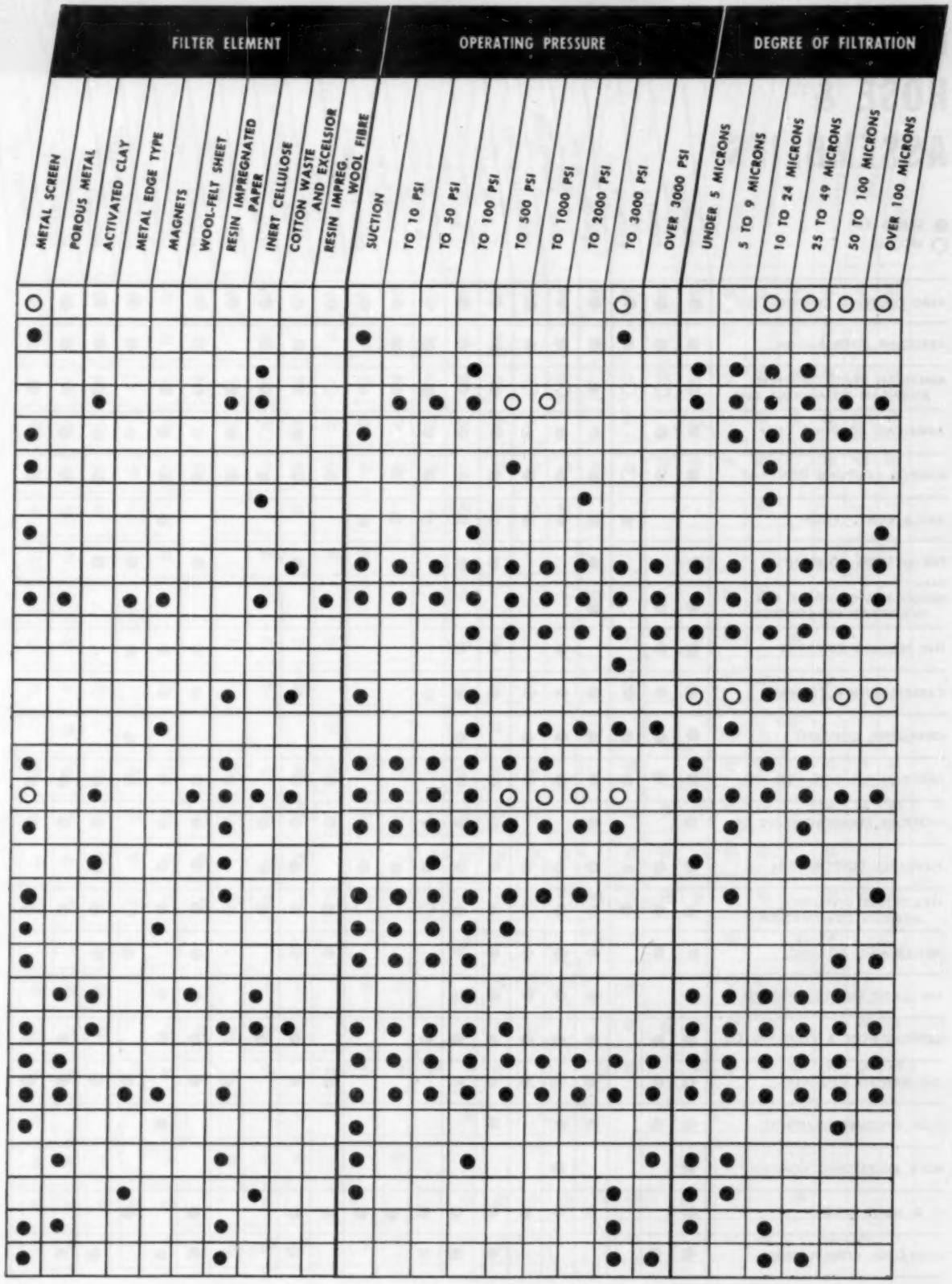
FILTER ELEMENT
METAL SCREEN
POROUS METAL
ACTIVATED CLAY
METAL EDGE TYPE
MAGNETS
WOOL-FELT SHEET
RESIN IMPREGNATED PAPER
INERT CELLULOSE
COTTON WASTE AND EXCELSIOR
RESIN IMPREG. WOOL FIBRE
OPERATING PRESSURE
SUCTION
TO 10 PSI
TO 50 PSI
TO 100 PSI
TO 500 PSI
TO 1000 PSI
TO 2000 PSI
TO 3000 PSI
OVER 3000 PSI
DEGREE OF FILTRATION
UNDER 5 MICRONS
5 TO 9 MICRONS
10 TO 24 MICRONS
25 TO 49 MICRONS
50 TO 100 MICRONS
OVER 100 MICRONS

FITTINGS, HOSE & ASSEMBLIES

● STANDARD
○ SPECIAL

		USE				MEDIUM			MEDIUM PRESSURE ASSEMBLY														
									HOSE I.D.					FITTINGS[3]									
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	⅜ TO ⅝ INCH	½ TO 1 INCH	1¼ TO 2 INCHES	2 TO 3 INCHES	OVER 3 INCHES	CLAMP TYPE	FEMALE PIPE THREAD	FLANGE	37° FLARE NOSE	MALE PIPE THREAD	PERMANENT	QUICK CONNECT	REUSABLE	JIC SWIVEL 37°	SAE SWIVEL 45°
	AERO-COUPLING CORPORATION	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●
*	AEROQUIP CORPORATION	●	●	●	●	●	●	●	●	●	●	●		●	●		●		●	●	●	●
	AMERICAN BRASS COMPANY AMERICAN METAL HOSE DIV.	●	○	○	●	○	○	●	●	●	●	●	○	●	●	●	●	●		●	●	●
	AMERICAN COUPLING CORP.	●	●		●	●	●	●	●	●				●	○	●	●	●	●	●	●	●
*	ANCHOR COUPLING COMPANY	●	●	○	●	●	●	●	●	●	●		●	●	●	●	●	●		●	●	●
	AVICA CORPORATION			●	●	●	●	●	●	●	●	●						●				
*	THE BELLOWS COMPANY	●			●			●	●					●			●		●	●		
	BENDIX-WESTINGHOUSE AAB INDUSTRIAL AIR CONTROLS	●	●		●																	
	THE BRUNING COMPANY	●	●			●		●	●								●	●	●			
	CARLYLE RUBBER COMPANY	●	●	●	●	●	●	●	●	●				●			●	●				
*	CHAR-LYNN COMPANY	●	●	●	●	●	●		●										●			
	EASTMAN ATLANTIC MFG. CO.	●	●	●	●	●	●	●	●				●	●		●	●	●	●	●	●	●
*	EASTMAN MANUFACTURING CO.	●			●			●	●	●			●	●	●	●	●	●		●	●	●
	FLEXONICS CORPORATION	●	●	●	●	●	●	●	●	●	●	●		●	●		●	●		●		
	FLEX-O-TUBE DIVISION MERIDAN CORPORATION	●	●	●	●	●	○	●	●	○	○	○	●	●	●	●	●	●	○	●	●	●
	FOSTER MFG. CO., INC.	●	●		●	●	●	●	●				●	●			●		●	●		
	THE GATES RUBBER COMPANY	●			●	●	●	●	●								●	●		●	●	
	GENERAL HOSE & COUPLING CO.	●	●		●	●	●	●	●	●				●	●	●	●	●			●	●
*	THE HANSEN MFG. CO.	●	●		●	●	●	●	●				●	●		●	●		●	●	●	●
	HIGH PRESSURE EQUIPMENT	●	●		●	●		●										●				
*	HOSE ACCESSORIES COMPANY	●				●																
*	C. B. HUNT & SON	●			●	●	●	●	●	●	●	●	●	●			●		●			
*	HYDRALINK CORPORATION	●	●					●	●	●				●		●	●	●		●	●	

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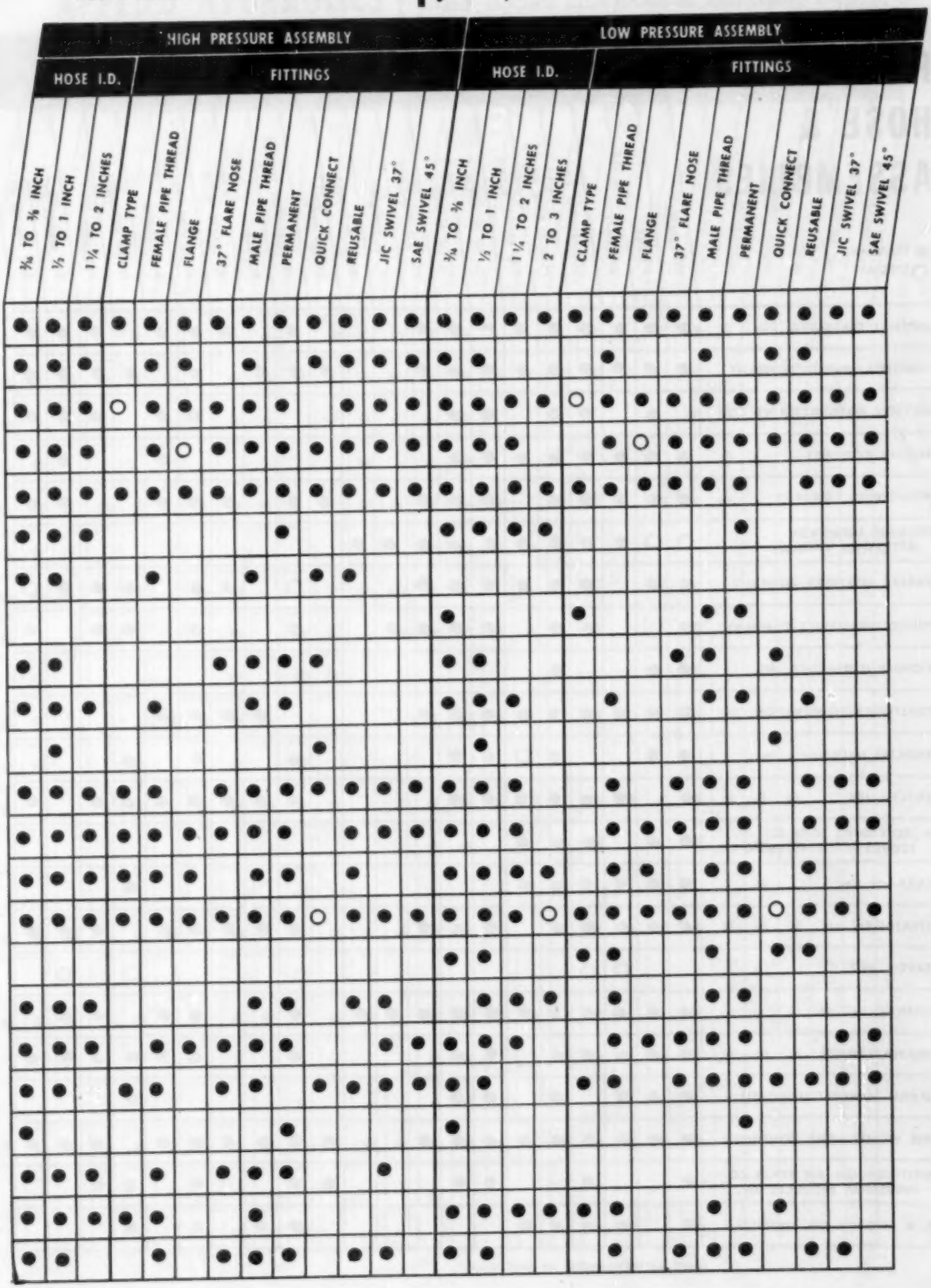

HIGH PRESSURE ASSEMBLY
HOSE I.D.
FITTINGS
⅜ TO ⅜ INCH
½ TO 1 INCH
1¼ TO 2 INCHES
CLAMP TYPE
FEMALE PIPE THREAD
FLANGE
37° FLARE NOSE
MALE PIPE THREAD
PERMANENT
QUICK CONNECT
REUSABLE
JIC SWIVEL 37°
SAE SWIVEL 45°
LOW PRESSURE ASSEMBLY
HOSE I.D.
FITTINGS
⅜ TO ⅜ INCH
½ TO 1 INCH
1¼ TO 2 INCHES
2 TO 3 INCHES
CLAMP TYPE
FEMALE PIPE THREAD
FLANGE
37° FLARE NOSE
MALE PIPE THREAD
PERMANENT
QUICK CONNECT
REUSABLE
JIC SWIVEL 37°
SAE SWIVEL 45°

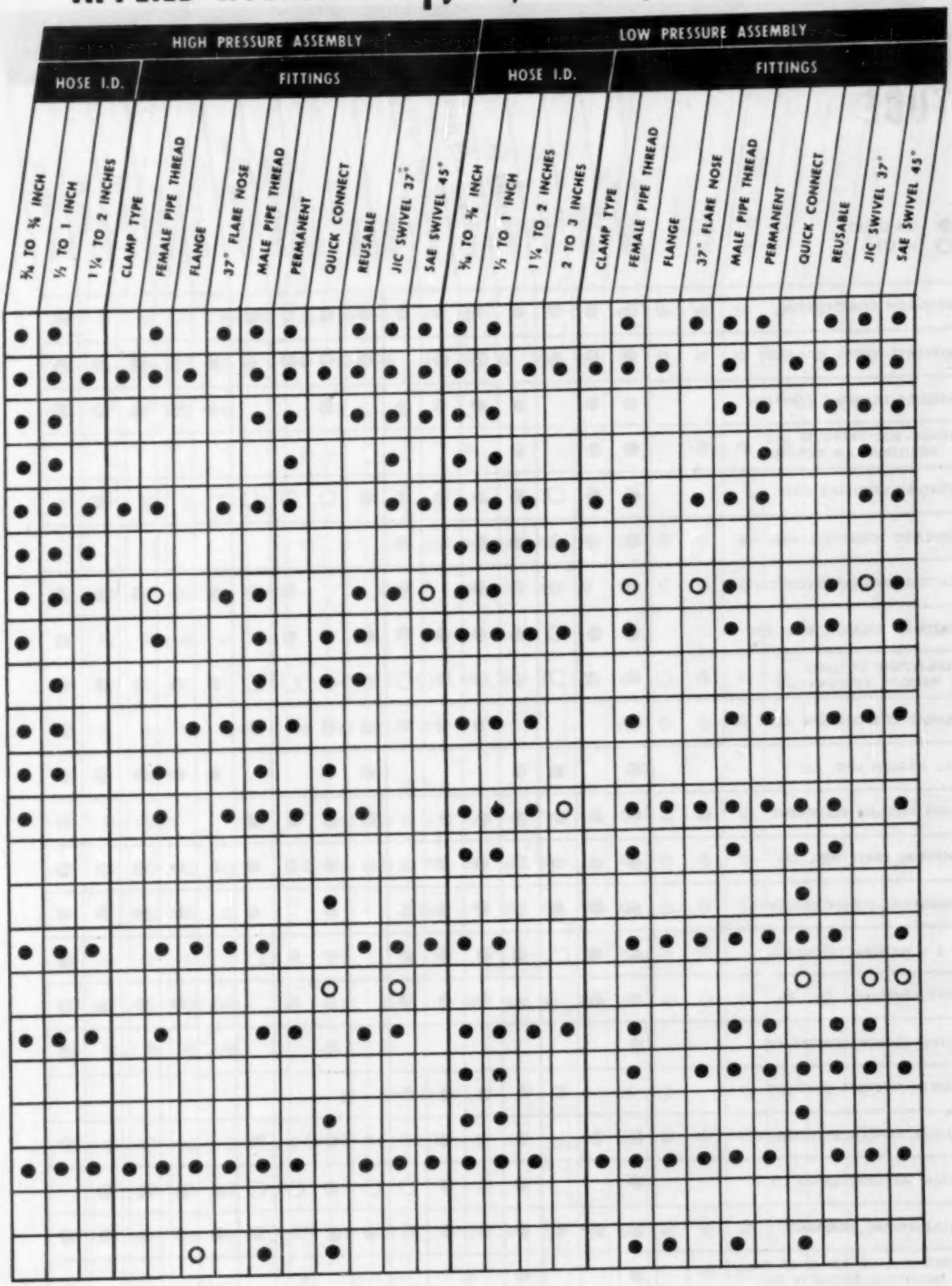
FITTINGS, HOSE & ASSEMBLIES

● STANDARD
○ SPECIAL

		USE				MEDIUM			MEDIUM PRESSURE ASSEMBLY															
									HOSE I.D.					FITTINGS										
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	⅜ TO ⅝ INCH	½ TO 1 INCH	1¼ TO 2 INCHES	2 TO 3 INCHES	OVER 3 INCHES	CLAMP TYPE	FEMALE PIPE THREAD	FLANGE	37° FLARE NOSE	MALE PIPE THREAD	PERMANENT	QUICK CONNECT	REUSABLE	JIC SWIVEL 37°	SAE SWIVEL 45°
*	IMPERIAL BRASS MFG. CO.	●	●	●	●	●	●	●	●	●				●		●	●	●		●	●	●
	INDUSTRIAL RUBBER COMPANY	●	●	●	●	●	●	●	●	●			●	●	●		●		●	●	●	●
*	MAYSON MANUFACTURING CO.		●		●	●		●	●								●	●		●	●	●
	MIC-LIN COMPANY	●	●	●	●	●	●	●	●									●			●	
	MULCONROY COMPANY	●	●	●	●	●		●	●	●			●	●		●	●	●			●	●
	ORCHARD INDUSTRIES ACTIONFLEX DIVISION	○	○	●	●	●	●	●	●	●	●	●										
*	PARKER APPLIANCE COMPANY	●	●		●	●	●	●	●	●				○		●	●		●	●	●	○
	PERFECTING SERVICE COMPANY	●			●	●		●	●	●	●			●			●		●	●		●
	PIONEER HYDRAULICS, INC.	●	●			●																
*	RESISTOFLEX CORPORATION	●	●	●	●	●	●	●	●	●					●	●	●	●				
	RODGERS HYDRAULICS, INC.	●	●			●	○	●	●					●			●		●			
	ROYLYN, INC.	●		●	●	●	●	●	●					●	●	●	●	●	●	●		●
*	A. SCHRADER'S SONS DIV. SCOVILL MANUFACTURING CO.	●	●		●	●	●															
*	SNAP-TITE, INC.	●	●	●	●	●	●												●			
*	STRATOFLEX, INC.	●	●	●	●	●		●	●	●				●	●	●	●	●		●	●	●
	TAVCO, INC.			○	○														○		○	
*	TITEFLEX, INC.	●	●	●	●	●	●	●	●	●	●	●		●			●	●		●	●	
*	TRU-FLATE, INC.	●	●	●	●	●		●	●					●			●	●	●	●	●	●
	ULRICH MANUFACTURING CO.	●	●	●		●		●	●										●			
*	THE WEATHERHEAD COMPANY	●	●	●	●	●	●	●	●	●			●	●	●	●	●	●		●	●	●
	WESTINGHOUSE AIR BRAKE CO. INDUSTRIAL PRODUCTS DIV.	●			●			●	●				●	●			●		●	●		
	E. B. WIGGINS OIL TOOL CO.	●		●	●	●	●							●	●		●		●			

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



FITTINGS, TUBE

● STANDARD
○ SPECIAL

	USE				MEDIUM				FLARED								
									MATERIAL			MAX. OPER. PRESSURE					
	INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROLEUM BASE FLUIDS	FIRE-RESISTANT FLUIDS	WATER	BRASS	STEEL	STAINLESS STEEL	ALUMINUM ALLOY	TO 300 PSI	TO 500 PSI	TO 1000 PSI	TO 2000 PSI	OVER 3000 PSI
* AEROQUIP CORPORATION	●	●	●	●	●	●	●	●	●	●	●					●
AIRCRAFT FITTING COMPANY	●	●	●		●	●		●	●	●	●	●	●	●	●	●
* ANCHOR COUPLING COMPANY	●	●		●	●	●	●		●			●	●	●	●	●
BENDIX-WESTINGHOUSE AAB INDUSTRIAL AIR CONTROLS	●	●		●												
CENTURY CONTROLS CORP.	●	●	○	●	●	●	●	●	○	○	○				●	
CHICAGO FORGING & MFG. CO.	●	●	●	●	●	●	●									
EASTERN AIRCRAFT PRODUCTS	●		●	●	●		●			●	●	●	●	●	●	●
EASTMAN ATLANTIC MFG. CO.	●	●	○	●	●	●	●	●	●	●						●
FLEX-O-TUBE DIVISION MERIDAN CORPORATION	●	●	○	●	●	●	○	●	●	○	○	●	●	●	●	●
* FLODAR CORPORATION	●				●	●	●	●	●	●	●					●
* THE HANSEN MFG. CO.	●		●	●				●	●			●	●	●	●	●
HIGH PRESSURE EQUIPMENT	●	●	●	●	●	●	●	●	●	●	●					●
* IMPERIAL BRASS MFG. CO.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
INDUSTRIAL RUBBER COMPANY	●	●	●	●	●	●	●		●		●		●	●	●	●
* L & L MANUFACTURING CO.	●	●	○	●	●	●	●		●	●	○					●
* LENZ COMPANY	●	●		●	●	●	●		●	●		●	●	●	●	●
OLIVET MANUFACTURING CO.	●								●							●
PARKER AIRCRAFT COMPANY			●	●	●	●	●									
* PARKER APPLIANCE COMPANY	●	●		●	●	●	●	●	●	●	●					●
* PETCH MANUFACTURING CO.	●			●	●	●	○	○	●	○	○	●	●	●	●	
* WEATHERHEAD COMPANY	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
WESTINGHOUSE AIR BRAKE CO. INDUSTRIAL PRODUCTS DIV.	●			●												

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*

TYPE							FLARELESS TYPE														
THREADS		TUBE SIZE					MATERIAL				MAX. OPERATING PRESS.					THREADS		TUBE SIZE			
STRAIGHT	PIPE	⅛ TO ½ INCH	⅝ TO 1 INCH	1¼ TO 2 INCHES	OVER 2 INCHES	BRASS	STEEL	STAINLESS STEEL	ALUMINUM ALLOY	TO 200 PSI	TO 500 PSI	TO 1000 PSI	TO 2000 PSI	OVER 3000 PSI	STRAIGHT	PIPE	⅛ TO ½ INCH	⅝ TO 1 INCH	1¼ TO 2 INCHES	OVER 2 INCHES
●	●	●	●	●	●	●	●	●	●	●				●	●	●	●	●	●	●
●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	
●	●	●	●	●																
						●				●						●	●	●		
●	●	●	●	○																
						●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●																
○	●	●	●	●	○	○	●	○	○	●	●	●	●	●	○	●	●	●	○	○
●	●	●	●	●		●	●	●	●					●	●	●	●	●	●	
●	●	●																		
●	●	●					●	●	●					●	●	●	●			
●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	
		●	●	●			●		●		●	●	●	●	●	●	●	●	●	
●	●	●	●	●	○		●							●	●	●			●	
●	●	●	●	●			●	●		●	●	●	●	●	●	●	●	●	●	
●	●	●	●	●																
							●	●	●					●	●		●	●	●	●
●	●	●	●	●	○	●	●	○	○					●	●	●	●	●	●	○
	●	●	●	●																
●	●	●	●	●	○	○	●	●	○	●	●	●	●	●	●	●	●	●	●	○
						●				●						●	●			

JOINTS, FLUID LINE

● STANDARD
○ SPECIAL

		USE				MEDIUM				TYPES						WORKING PRESSURE RATING (NON SHOCK)					
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	WATER	BALL BEARING DESIGN	BALL & SOCKET DESIGN	SINGLE PLANE SWIVEL	DOUBLE PLANE SWIVEL	TRIPLE PLANE SWIVEL	ROTATING OR REVOLVING JOINT	TO 300 PSI	TO 1000 PSI	TO 2000 PSI	TO 3000 PSI	TO 6000 PSI	OVER 6000 PSI
	AMERICAN COUPLING CORP.	●			●	●	●	●			●	○		●	●	●	●	●	●	○
*	BARCO MANUFACTURING CO.	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●		
	THE BRUNING COMPANY	●	●	○	●	●		○	●		●			●	●					
*	CHIKSAN COMPANY	●	●	○	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●
	EASTERN AIRCRAFT PRODUCTS			●	●	●		●		●				●	●	●	●	●	●	
	EMSCO MANUFACTURING CO.	●	●	○	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●
	FLEXONICS CORPORATION	●	●	●	●	●		●							●	○	○	○	○	○
*	THE HANSEN MFG. CO.	●	●		●	●	●	●			●									●
*	C. B. HUNT & SON	●			●	●	●	●	●		●			●	●	●				
	HYDRAULIC UNIT SPECIALTIES	●	●			●				●				●		●				
*	L & L MANUFACTURING CO.	●	●		●	●	○				●	○			●	●	●			
*	MAYSON MANUFACTURING CO.	●	●		●	●		●			●	●		●				●		
	PERFECTING SERVICE CO.	●			●	●	●	●	●		●			●	●		○			
	ROTHERM ENGINEERING CO.	●			●	●		●						●	●	●	●	●		
*	A. SCHRADER'S SONS DIV. SCOVILL MANUFACTURING CO.	●	●		●	●	●	●			●			●	●					
*	SEALOL CORPORATION	●	○	○	●	●	○	●	●		●	●	●	●				●	○	
*	TITEFLEX, INC.	●	●	●	●	●	●	●			●									
*	TRU-FLATE, INC.	●	○	○	●	●		●	●					●	●	●	●	●	●	●
	THE WEATHERHEAD COMPANY AIRCRAFT DIVISION			●		●	●				●			●				●		
	E. B. WIGGINS OIL TOOL CO.	●		●	●	●	●	●							●	●	●	●		

*SEE ADVERTISEMENT IN THIS ISSUE

PIPE SIZES												TUBE SIZES							HOUSING MATERIAL						END CONNECTION		
¼ INCH	⅜ INCH	½ INCH	¾ INCH	1 INCH	1¼ INCHES	1½ INCHES	2 INCHES	2½ INCHES	3 INCHES	4 INCHES AND OVER	¼ INCH O.D.	⅜ INCH O.D.	½ INCH O.D.	⅝ INCH O.D.	¾ INCH O.D.	1 INCH O.D.	MALLEABLE IRON	BRONZE	ALUMINUM	STEEL	STAINLESS STEEL	AN THREAD	STANDARD PIPE	NF THREAD	WELDING
●	●	●	●	●	●						●	●	●	●	●	●	●				●		○	●	●	
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●
●	●	●	●	●															●	●		●	●			
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●		●	●	●	●		
●	●	●	●	●	●	●	●	●	●	●	●	○	●	●	○	●	●	○	●	●	○	○	●	○	●
		●	●	●	●	●	●		●	●				●		●	●	●			●		●	●	●
●	●	●	●	●	●	●	●	●			●	●	●	●	●	●				●	●	●	●	●		
●	●	●	●	●														●					●			
●																				●		●	●	●		
●	●	●	●	●							●	●	●	●	●	●				●			●	●		
●	●	●	●	●	●	●	●				●	●	●	●					●	●	○	○	●			
●	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○	○		○	○	○	○	○	●	○	○
●	●	●	●	●	●	●	●	●	●	●								●	●	○	●	○		●		●
●	●	●	●								●	●	●	●				●			●	●		●		
●	●	●	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	●	●	○	●	○	○	●	○	○
●	●	●	●	●	●	●	●	●	●	●								●	●	●				●		
●	●	●	●	●																	●	○		●		
●	●	●	●	●							●	●	●	●	●	●					●	●				
●	●	●	●								●	●	●	●	●	●	●			●	●	●				

MOTORS, ELECTRIC, SQUIRREL CAGE A-C

● STANDARD
○ SPECIAL

	HORSEPOWER RATING					TORQUE CURRENT SLIP			MOUNTING				ENCLOSURE				FREQUENCY			
	½ TO 1	1 TO 5	5 TO 25	25 TO 75	75 TO 200	NEMA DESIGN B	NEMA DESIGN C	FOOT	VERTICAL	FLANGE	SPECIAL	OPEN DRIP-PROOF	SPLASH PROOF	TOTALLY ENCLOSED	TOT. ENCL. FAN COOLED	25 CYCLES	50 CYCLES	60 CYCLES	400 CYCLES
ACEC ELECTRIC CORPORATION	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	
ALLIS-CHALMERS MFG. CO.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○
LOUIS ALLIS COMPANY	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
AMERICAN ELECTRIC MOTORS DIV. AMERICAN ELECTRONICS	●					●	○	○	○	○	○	○	○	●	●				●
BALDOR ELECTRIC COMPANY	●	●	●			●	●	●	●	●	●				●	●	●	●	
BOGUE ELECTRIC MFG. CO.		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
CONTINENTAL ELECTRIC CO.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
CORNELIUS COMPANY		●								●				●					●
DIEHL MANUFACTURING CO.	●	●	●	●		●	●	●	●	●	○	●		●	●	○	●	●	
DOERR ELECTRIC CORP.	●	●				●	●	●	●	●	●	●	●	●	●	●	●	●	●
* ELECTRO DYNAMIC DIVISION GENERAL DYNAMICS CORP.	○	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
EMERSON ELECTRIC	●	●				●	●	●	○	○	○	●	○	●			●	●	
FAIRBANKS, MORSE & CO. ELECTRICAL DIVISION	●	●	●	●	●	●	●	●	●	●	○	●	●	●	●	●	●	●	○
GENERAL ELECTRIC COMPANY	●	●	●	●	●	●	●	●		●		●		●				●	●
HOWELL ELECTRIC MOTORS CO.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
JACK & HEINTZ, INC.	●							●	●	●	●	●	●	●		●	●	●	●
LEAR, INC.	○									○				○	○				○
LIMA ELECTRIC MOTOR CO.	●	●	●	●	●	●	●	●	●	●	●	●		●	●		●	●	
MASTER ELECTRIC COMPANY	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
NATIONAL PNEUMATIC COMPANY HOLTZER-CABOT DIVISION	○	○				○		○	○	○	○	○		○	○	○	○	○	○
PEERLESS ELECTRIC COMPANY	●	●	●			●	●	●	●	●	●	●	●	●	●	●	●	●	
PESCO PRODUCTS DIV. BORG-WARNER CORPORATION	○	○						○	○	○	○	○	○	○					○
RELIANCE ELECTRIC & ENGR'G CO.		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
REULAND ELECTRIC COMPANY	●	●	●			●	●	●	●	●	●	●	●	●	●	●	●	●	
ROBBINS & MYERS, INC.	●	●	●	●	●	●	●	●				●	●	●	●	●	●	●	
STAR-KIMBLE MOTOR DIV. MIEHLE PRESS & MFG. CO.	○	○	○	○	○			○	○	○	○	○	○	○	○	○	○	○	○
STERLING ELECTRIC MOTORS	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	
U. S. ELECTRICAL MOTORS CO.	●	●	●	●	●	●	●	●	●	●	○	●	●	●	●	●	●	●	●
WAGNER ELECTRIC COMPANY	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	

*SEE ADVERTISEMENT IN THIS ISSUE

VOLTAGE						PHASE		SPEED (60 CYCLES)						SHAFT							BEARINGS	FEATURES				
110	208	220	440	550	2300	TWO	THREE	600 RPM	720 RPM	900 RPM	1200 RPM	1800 RPM	3600 RPM	EXTRA LONG	DOUBLE EXTENSION	TAPERED	HOLLOW	SPLINED	THREADED	BALL	SLEEVE	PUMP MOUNTING FLANGE	GEARING	BRAKE	CLUTCH	THERMAL PROTECTION
●	●	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●
●	●	●	●	●	●	○	●	●	●	●	●	●	●	○	○	○	○	○	○	●	●	○	○	○	○	○
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
●	●	●	○	○	○	○	●							○	○	○	○	○	○	●		○	○	○	○	○
●	●	●	●	●		●	●			●	●	●	●	●	●	●		●	●	●		●		●		●
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●					●
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
●		●					●											●		●						
●	●	●	●	●		●	●	○	○	●	●	●	●	○	○	●	○	●	●	●	●	●	○	●	○	○
●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●		●	●		●	●	●		●
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●		●
●	●	●	○	○		●	●			○	●	●	○	○	○				○	●	●					●
●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	●	●	●	○	●	●	●	●	●	●	○	●
	●						●							●	●			●	●	●		●				●
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●		●
●	●	●	●	●			●				●	●	●	●	●	●	●	●	●	●	●	●		●		●
○	○					○	○								○			○	○	○		○	○	○	○	○
●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○	●		●	●	●		●
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
○	○	○	○			○	○				○	○	○	○	○	○			○	○	○	○	○			○
●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●		●		●
	○						○							○	○	○	○	○	○	○		○	○	○	○	
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●		●	●	●		●
●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●		
●	●	●	●	●		●	●	●	●	●	●	●		○	○	○	○	○	○	●		●		●		
○	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○		○	○	○				○		○
●	●	●	●	●		●	●	●	●	●	●	●	●	○	○	○		○	○	●		○	●	●	○	○
●	●	●	●	●	●	●	●	○	●	●	●	●	●	○	●	○	●	○	●	●		●	●	●	○	○
●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●			●	●	●	●				

MOTORS, FLUID, GEAR TYPE

● STANDARD
○ SPECIAL

		USE				MEDIUM		MAXIMUM PRESSURE				HORSEPOWER OUTPUT					MAX. SHAFT SPEED RPM						MOUNTING		
		INDUSTRIAL	MOBILE	AIRCRAFT	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	TO 1	1 TO 3	3 TO 5	5 TO 10	10 TO 20	TO 600	TO 1000	TO 1500	TO 2000	TO 3000	FLANGE	FOOT	PAD SUBPLATE
*	CHAR-LYNN COMPANY	○	○	○	○	○	○	○	○	○	○	○			○	○	○	○		○		○
*	COMMERCIAL SHEARING & STAMPING COMPANY	●	●		●			●	●		●	●	●	●	●	●	●	●		●	●	
	DOWTY HYDRAULICS UNITS LTD.	●	●		●	●			●					●					●		●	
*	EASTERN INDUSTRIES	●	●		●	○	●			●	●	●						●	●	●	●	●
*	GEROTOR MAY CORPORATION	●			●	●			●	●	●	●	●				●			●	●	
*	HYDRAULIC POWER DIVISION HYDRAULIC PRESS MFG. CO.	●	●		●	●	●				●	●	●	●			●			●	●	●
*	I LAVITE ROTARY PUMPS & MOTORS LTD.	●	●		●	○			●	●	●	●	●	●					●	●	●	
*	NEW YORK AIR BRAKE CO. KALAMAZOO DIVISION	●	●		●	●	●	●		●	●	●	●	●				●		●	●	○
	PESCO PRODUCTS DIVISION BORG-WARNER CORPORATION		●	●	●				●		●	●	●	●			●			●	●	
*	GEORGE D. ROPER CORP.	●	●		●	○	●	○		●	●	●	●	●		●		○		●	●	○
	WISCONSIN HYDRAULICS, INC.	●	●	●	●	●			●	●	●	●	●					●		●	●	●

*SEE ADVERTISEMENT IN THIS ISSUE

MOTORS, FLUID, VANE TYPE

● STANDARD
○ SPECIAL

		USE				MEDIUM		MAX. SHAFT SPEED RPM					MINIMUM SHAFT SPEED RPM AT LOAD			DISPLACEMENT CU. IN. PER REV. AT 0 PSI							
		INDUSTRIAL	MOBILE	AIRCRAFT	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	TO 600	TO 1000	TO 1500	TO 2000	OVER 2000	UNDER 50	UNDER 150	UNDER 400	TO 1	1 TO 1.9	2 TO 4.9	5 TO 6.9	7 TO 9.9	10 TO 14.9	15 TO 24.9	25 TO 40 & UP
*	AIRWAY PRODUCTS, INC.	○	○		○	○																○
*	DENISON ENGINEERING DIV. AMERICAN BRAKE SHOE CO.	●	●		●	○	●	●	●	●			●		●	●	●	●	●	●	●	
*	NEW YORK AIR BRAKE CO. KALAMAZOO DIVISION	●	●		●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●
*	RACINE HYDRAULICS & MACHINERY, INC.	●	●		●	○					●	●			●	●	●					
	ROCKWELL MANUFACTURING CO.	●	○		●	●	●	●	●	●	●	●	●	●					●	●	●	●
*	VICKERS, INC. DIVISION OF SPERRY RAND	●	●		●	●				●		●				●	●	●	●			

*SEE ADVERTISEMENT IN THIS ISSUE

MIN. SHAFT SPEED AT LOAD			DISPLACEMENT CU. IN. PER REV. AT 0 PSI							TORQUE LB. IN. PER 100 PSI							SHAFT				GEARS				PORTS		
UNDER 150 RPM	UNDER 400 RPM	TO 1	1 TO 1.9	2 TO 4.9	5 TO 9.9	10 TO 14.9	15 TO 24.9	25 TO 40	TO 5	5 TO 10	10 TO 20	20 TO 50	50 TO 100	100 TO 500	500 TO 800	SPLINED	STRAIGHT-KEY	TAPERED AND THREADED	FOR BELT DRIVE	SPUR	HELICAL	HERRINGBONE	INTERNAL	STRAIGHT THREAD	TAPERED PIPE THREAD	FLANGE CONNECTION
○		○	○	○	○				○	○	○	○	○	○	○		○		○				○		○	○
	●		●	●	●	●					●	●	●	●		●	●	●	●	●	●			●	●	●
	●																●			●						●
	●	●	○						●	●	○					●	●		●	●				●	○	
	●				●									●			●						●	●		
			●	●	●	●				●	●	●	●	●			●		●	●					●	●
●		●	●	●	●	●	●	●	●	●	●	●	●	●	●		●		○	●				●	○	●
		●	●	●	●	○	○			○	●	●	●	○		●	●		●	●				○	●	●
	●		●	●	●						●	●					●			●					●	
●				●	●	●						●	●			○	●	○	●	○	●			○	●	
	●		●	●	●				●	●	●	●				○	●	○	●	●				○	●	○

MAXIMUM PRESSURE RATING				TORQUE LB. IN. PER 100 PSI							HOSEPOWER OUTPUT						MOUNTING			PORTS			DRIVE SHAFT		
TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	OVER 2000 PSI	TO 5	5 TO 10	10 TO 20	20 TO 50	50 TO 100	100 TO 500	500 TO 800 & UP	TO 5	5 TO 10	10 TO 15	15 TO 30	30 TO 60	60 TO 125 & UP	FOOT	FLANGE	PAD — SUBPLATE	STRAIGHT THREAD	TAPERED PIPE THREAD	FLANGE CONNECTION	SPLINED	STRAIGHT-KEY	TAPERED & THREADED	FOR BELT DRIVE
	●		○																							
●	●	●		●	●	●	●	●	●		●	●	●	●	●	●	●	●	○	○	●	●	○	●	○	●
		●			●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	●	●	●	○	●	●
	●			●	●	●	●				●	●	●	●			●	●			●	●		●		●
●	●						●	●	●	●	●	●	●	●	●	●	●	●			●	●	○	●		
●						●	●	●	●		●	●	●	●			●	●		●	●	●		●		

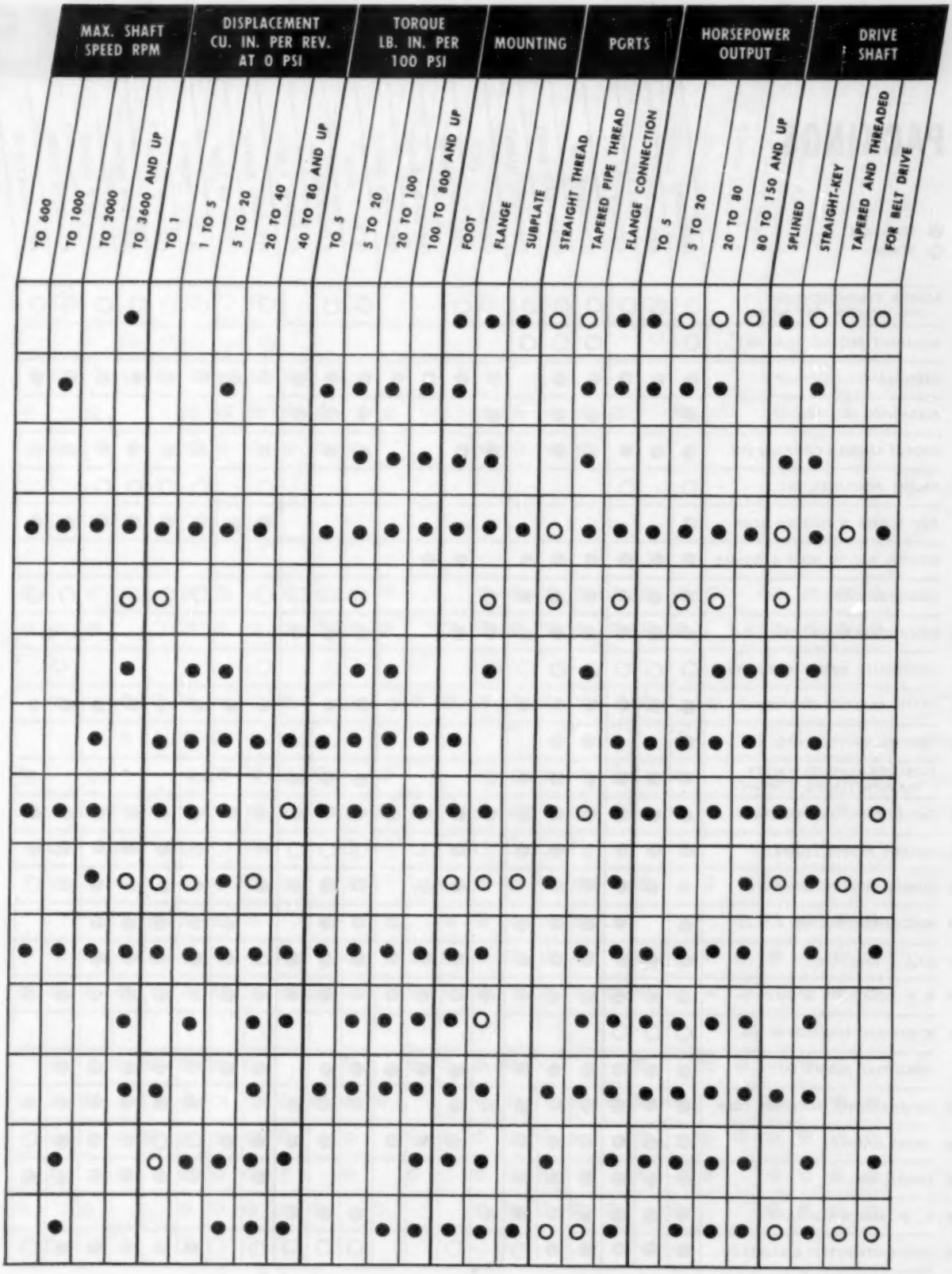
MOTORS, FLUID, PISTON TYPE

● STANDARD
○ SPECIAL

		USE				MEDIUM			TYPES											MAXIMUM PRESSURE RATING			MINIMUM SHAFT SPEED AT LOAD		
									VARIABLE DISPLACEMENT																
		INDUSTRIAL	MOBILE	AIRCRAFT	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	FIXED DISPLACEMENT	HAND WHEEL CONTROL	ELEC. MTR. CONTROL	SERVO MTR. CONTROL	CYLINDER CONTROL	STEM CONTROL	PRESS. COMPENSATOR	AXIAL PISTON	RADIAL PISTON	ROTARY ABUTMENT	TO 1000 PSI	TO 3000 PSI	TO 5000 PSI AND UP	UNDER 50 RPM	UNDER 150 RPM	UNDER 400 RPM
	AIRWAY PRODUCTS, INC.	○	○	○	○	○	○											●		●			
*	AMERICAN ENGINEERING CO.	●			●										●		●			●			
*	CARTER CONTROLS, INC.	●	●		●	●	●			●	●			●									
*	DENISON ENGINEERING DIV. AMERICAN BRAKE SHOE CO.	●	●	●	●	○	●	●	○	○	●	●	●	●			●	●	●		●		
	DOWTY EQUIPMENT LTD.			○		○	○							○	○				○			○	
	HYDRAMOTIVE, INC.	●	●		●	●		●						●				●					●
*	HYDRAULIC POWER DIVISION HYDRAULIC PRESS MFG. CO.	●			●	●	●	●		●			●		●			●					
*	KEELAVITE ROTARY PUMPS & MOTORS LTD.	●	●		●	○	●				●	●	●			●	●	●		○	●	●	
	OIL-DYNE, INC.	●	○	●	●	●	●	●	●	●	●	●	●	●					●				
*	OILGEAR COMPANY	●			●	●	●	●	●	●	●	●	●	●	●		●	●		●			
	OLIVER IRON & STEEL CORP. BERRY DIVISION	●	●		●	●										●		●		●			
*	VICKERS, INC. DIVISION OF SPERRY RAND	●		●	●	●	●	●	●	●	●	●	●	●				●		●			
*	VICKERS-ARMSTRONGS LTD.	●			●	●	●	●	●	●	●	●	●	●				●			●		
	WATERBURY TOOL DIVISION VICKERS, INC.	●			●	●	●	●	●	●	●	●	●					●		●			

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*

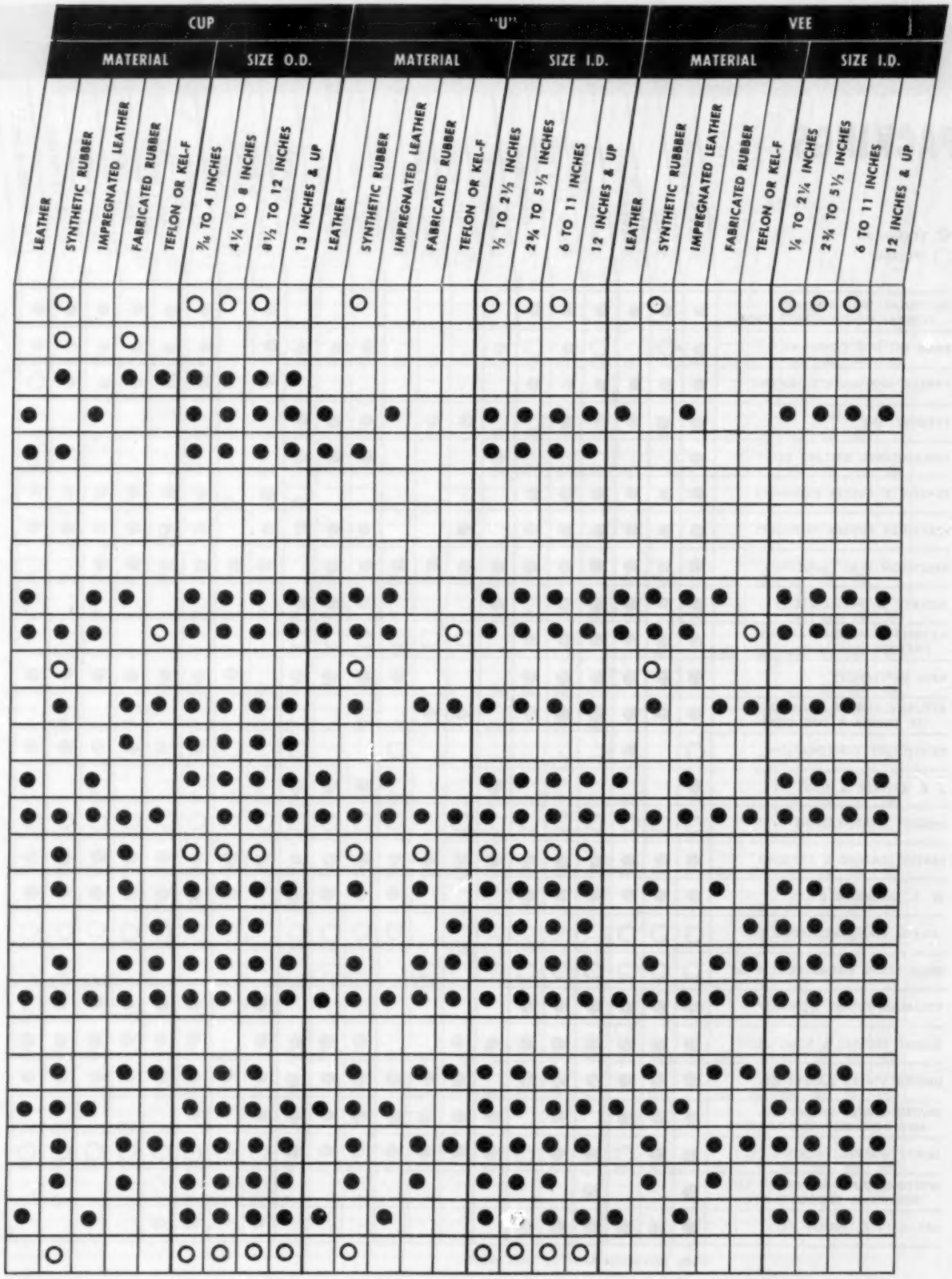


PACKINGS

● STANDARD
○ SPECIAL

	USE				MEDIUM			FLANGE							O-RING							
								MATERIAL				SIZE I.D.			MAT'L	SIZE I.D.						
	INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL BASE FLUIDS	FIRE-RESIST. FLUIDS	LEATHER	SYNTHETIC RUBBER	FABRICATED RUBBER	TEFLON OR KEL-F	½ TO 1 INCH	2 TO 10 INCHES	12 INCHES & UP	SYNTHETIC RUBBER	TEFLON OR KEL-F	1/16 TO 1 INCH	1 1/16 TO 2 INCHES	2 1/16 TO 4 INCHES	4 1/16 TO 8 INCHES	8 1/16 TO 15 INCHES	15 1/16 INCHES & UP
ACADIA SYNTHETIC PRODUCTS DIV. WESTERN FELT WORKS	○	○	○	○	○	○		○			○	○		○		○	○	○	○	○	○
ACUSHNET PROCESS COMPANY	○			○	○	○								○							
AERO GASKET COMPANY	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
ALEXANDER BROTHERS	●			●	●		●				●	●	●								
GEORGE ANGUS & COMPANY LTD.	●	●	●	●	●		●	●			●	●		●		●	●	●	●	●	●
BACON INDUSTRIES, INC.	○		○											○		○	○	○	○		
BAY RUBBER & PLASTICS CORP.	●													●	●	●	●	●	●	●	●
BOSTON WOVEN HOSE & RUBBER	●	●	●	●	●	●		●	●												
CHICAGO-ALLIS MFG. CORP.	●	●	●	●	●	●	●				●	○	○	○		○	○	○	○	○	○
* CHICAGO RAWHIDE MFG. CO.	●	●	●	●	●	●	●	●			●	●	●								
CONTROLLED RUBBER PRODUCTS	○	○	○	○	○	○								○							
* CRANE PACKING COMPANY	●	●	●	●	●	●				●	●	●		●	●	●	●	●	●	●	●
* DARLING VALVE & MFG. CO.	●			●	●																
EXCELSIOR LEATHER WASHER MANUFACTURING COMPANY	●	●	●	●	●	●	●				●	●	●								
* GARLOCK PACKING COMPANY	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
* GOSHEN RUBBER COMPANY	●	●	●	●	●	●		●			○	○	○	●		●	●	●	●	●	●
* GREENE-TWEED & COMPANY	●	●	●	●	●			●	●		●	●	●	●		●	●	●	●	●	○
* HALOGEN INSULATOR & SEAL	●		●	●	●	●				●	●	●			●	●	●	●	●		
* HALL & HALL, LTD.	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●		
* E. F. HOUGHTON & CO.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
* HYDRAULIC ACCESSORIES CO.	○	○	○																		
INDUSTRIAL RUBBER CO.	●	●	●	●	●	●		●	●	●	●	●		●	●	●	●	●	●	●	
* INTERNATIONAL PACKINGS CORP.	●	●	●	●	●	●	●	●			●	●	●	●		●	●	●	●	●	●
* JOHNS-MANVILLE	●	●	●	●	●	●		●	●	●		●	●	●	●	○	○	●	●	●	○
* LINEAR, INC.	●	●	●	●	●	●								●		●	●	●	●	●	●
* C. W. MARSH COMPANY	●	●	●	●	●	●	●				●	●	●								
* MINNESOTA RUBBER & GASKET CO.	●	●	●	●	●	○		○			○	○	○	○		●	●	●	●	●	○

*SEE ADVERTISEMENT IN THIS ISSUE

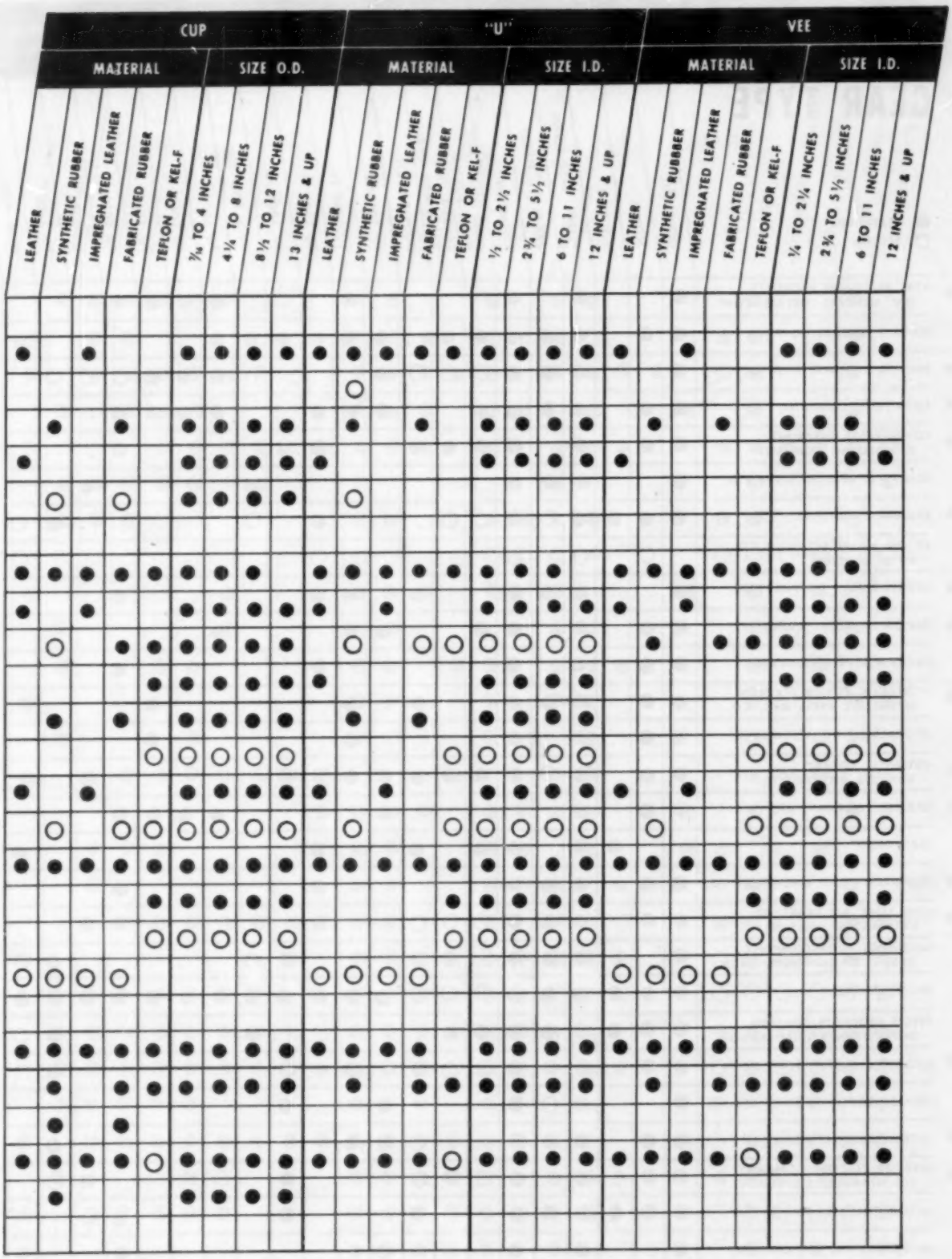

CUP
"U"
VEE
MATERIAL
SIZE O.D.
SIZE I.D.
LEATHER
SYNTHETIC RUBBER
IMPREGNATED LEATHER
FABRICATED RUBBER
TEFLON OR KEL-F
⅜ TO 4 INCHES
4¼ TO 8 INCHES
8½ TO 12 INCHES
13 INCHES & UP
½ TO 2½ INCHES
2¾ TO 5½ INCHES
6 TO 11 INCHES
12 INCHES & UP
¼ TO 2¼ INCHES

PACKINGS

● STANDARD
○ SPECIAL

		USE				MEDIUM			FLANGE							O-RING							
									MATERIAL				SIZE I.D.			MAT'L	SIZE I.D.						
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	LEATHER	SYNTHETIC RUBBER	FABRICATED RUBBER	TEFLON OR KEL-F	½ TO 1 INCH	2 TO 10 INCHES	12 INCHES & UP	SYNTHETIC RUBBER	TEFLON OR KEL-F	⅛ TO 1 INCH	1⅛ TO 2 INCHES	2⅛ TO 4 INCHES	4¼ TO 8 INCHES	8½ TO 15 INCHES	15½ INCHES & UP
	NATIONAL SEAL DIVISION FEDERAL-MOGUL-BOWER BRGS.	●	●	●	●	●	●								●		●	●	●	●	●	●
*	PAGE BELTING COMPANY	●	○		○	●	○	●				●	●	●	●		●	●	●	●	●	●
*	PARKER APPLIANCE COMPANY	●	●	●	●	●	●								●		●	●	●	●	●	○
	PERIFLEX, INC.	●	●	●	●	●			●	●		●	●	●								
	PHILADELPHIA BELTING CO.	●						●				●	●	●								
*	PLASTIC & RUBBER PRODUCTS	●	●	●	●	●	●								●		●	●	●	●	●	●
*	PRECISION RUBBER PRODUCTS	●	●	●	●	●	●		●			●	●	●	●		●	●	●	●	●	●
	PRECISION SEAL INDUSTRIES	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●		
	HORACE G. PRESTON CO.	●	●	●	●	●		●				●	●	●								
*	RAYBESTOS-MANHATTAN, INC. PACKING DIVISION	●	●	●	●	●	●		○	○	○	○	○	○								
	REID ENTERPRISES	●	●	●	●	●	●				●	●	●	●		●	●	●	●	●	●	●
	REPUBLIC RUBBER DIVISION LEE RUBBER & TIRE CORP.	●	●	●	●	●	●		●	●												
*	RESISTOFLEX CORPORATION	○		●							○			○		○	●	●	●	●	●	●
*	J. E. RHOADS & SONS	●						●				●	●	●								
	ROGERS CORPORATION	○	○	○	○	○	○		○		○	○	○		○	○	○	○	○	○	○	○
	SEARLE LEATHER & PACKING	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	W. S. SHAMBAN & CO.	●	●	●	●	●	●				●	●	●	●		●	●	●	●	●	●	●
*	SPARTA MANUFACTURING CO.	○	○	○							○	○	○	○		○	○	○	○	○	○	○
	BRAD STILES MECHANICAL PKGS.	○	○	○	○	○	○															
	STILLMAN RUBBER COMPANY	●	●	●	●	●	●								●		●	●	●	●	●	
	ALBERT TROSTEL & SONS CO.	●	●	●	●	●	●	●	●			●	●	●	●		●	●	●	●	●	●
*	UNITED STATES GASKET CO.	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●
	UNITED STATES RUBBER CO. NEW YORK BELTING & PACKING	●	●	●		●		●	●	●	●	●	●	●	●		●					
	JAMES WALKER PACKING CO.	●	●	○	●	●	○	●	●	●	●	●	●	●	○	○	○	○	○	○	○	○
	WESTINGHOUSE AIR BRAKE CO. INDUSTRIAL PRODUCTS DIV.	●			●																	
*	FRANKLIN C. WOLFE CO.	●	●	●	●	●	●								●		●	●				

*SEE ADVERTISEMENT IN THIS ISSUE


CUP
MATERIAL
LEATHER
SYNTHETIC RUBBER
IMPREGNATED LEATHER
FABRICATED RUBBER
TEFLON OR KEL-F
SIZE O.D.
¾ TO 4 INCHES
4¼ TO 8 INCHES
8½ TO 12 INCHES
13 INCHES & UP
"U"
MATERIAL
LEATHER
SYNTHETIC RUBBER
IMPREGNATED LEATHER
FABRICATED RUBBER
TEFLON OR KEL-F
SIZE I.D.
½ TO 2½ INCHES
2¾ TO 5½ INCHES
6 TO 11 INCHES
12 INCHES & UP
VEE
MATERIAL
LEATHER
SYNTHETIC RUBBER
IMPREGNATED LEATHER
FABRICATED RUBBER
TEFLON OR KEL-F
SIZE I.D.
¾ TO 2¼ INCHES
2¾ TO 5½ INCHES
6 TO 11 INCHES
12 INCHES & UP

PUMPS
GEAR TYPE

● STANDARD
○ SPECIAL

		USE			MEDIUM		TYPES					MAX. PRESSURE					MAX. DRIVE SPEED RPM AT 0 PSI						
		INDUSTRIAL	MOBILE	AIRCRAFT	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	SINGLE UNIT	DUAL UNIT (SAME SIZE)	TANDEM UNIT (LARGE AND SMALL)	DOUBLE SHAFT	TO 500 PSI	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	OVER 2000 PSI	TO 600	TO 1000	TO 1500	TO 2000	TO 3000	TO 3600	OVER 4000
*	ADEL PRECISION PRODUCTS DIV. GENERAL METALS CORP.	●			●		●					●				●	●	●	●			
	JOHN S. BARNES CORP.	●	●		●	●	●	●	●		●	●	●	●	●	●						●
*	BROWN & SHARPE MFG. CO.	●			●	●	●	○	○	○	●					●	●	●	○	○	○	
*	CHAR-LYNN COMPANY	●	●		●	●	●	●			●	●	●			●	●	●	●			
*	COMMERCIAL SHEARING & STAMPING COMPANY	●	●		●		●	●	●	●			●	●					●			
	DOWTY HYDRAULIC UNITS LTD.	●			●	●	●								●					●		
*	EASTERN INDUSTRIES	●	●	●	●	○	●	○	○				●		○						●	○
	EATON MANUFACTURING CO. PUMP DIVISION		○		○		○						○									○
*	GEROTOR MAY CORPORATION	●			●	●	●			●		●	●						●			
*	GRESEN MANUFACTURING CO.	●	●		●		●	●			●	●				●						
	GROBAN SUPPLY COMPANY	●	●		●		●						●						●			
*	HYDRAULIC POWER DIVISION HYDRAULIC PRESS MFG. CO.	●	●		●	●	●			●		●						●				
	HYDRAULIC UNIT SPECIALTIES	●	●		●		●					●						●				
*	KEELAVITE ROTARY PUMPS & MOTORS LTD.	●	●		●	○	●	●	●	●	●	●	●	●						●		
*	KRAISSL COMPANY, INC.	●	●		●						●					●	●	●	●			
	LEAR, INC.			●	●		●	●		●			●									●
*	MONARCH ROAD MACHINERY CO.	●	●		●	●	●						●						●			
*	NEW YORK AIR BRAKE CO. KALAMAZOO DIVISION	●	●		●	●	●	○	○	○			●						●	●		
	NORTHERN PUMP COMPANY SUBS'Y. OF NORTHERN ORDN.	●			●	●	●		●	●				●	○						●	○
	OIL-DYNE, INC.	●	●	●	●	●	●	○	○	○	●	●	●	●	●	●	●	●	●	●	●	●
	PESCO PRODUCTS DIVISION BORG-WARNER CORPORATION	●	●	●	●	●	●	●	●						●						●	○
*	GEORGE D. ROPER CORP.	●	●		●	●	●	○	○	●		●		○							●	○
	TOWLER BROS. (PATENTS) LTD.	●			●	○	●				●			●								
*	TUTHILL PUMP COMPANY	●	●		●	●	●			○	●	●									●	
*	WEBSTER ELECTRIC COMPANY OIL HYDRAULICS DIVISION	●	●		●		●	○	●	○				●						●	○	
	WISCONSIN HYDRAULICS, INC.	●	●	●	●	●	●			●				●					●	○		
	WORTHINGTON CORPORATION	●			●		●			●	○								●			

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*

MIN. SHAFT SPEED AT LOAD		CAPACITY RANGE CU. IN. PER REV. AT 0 PSI									ROTATION				MOUNTING			GEARS					DRIVE SHAFT			PORTS		
UNDER 300 RPM	UNDER 500 RPM	TO .2	.2 TO .9	1 TO 1.9	2 TO 3.9	4 TO 6.9	7 TO 9.9	10 TO 14.5	OVER 14.5	CLOCKWISE	COUNTER-CLOCKWISE	REVERSIBLE – PORTS CHANGE	REVERSIBLE – WITHOUT PORTS CHANGE	FLANGE	PAD – SUBPLATE	FOOT	SPUR	HELICAL	HERRINGBONE	INTERNAL	SPLINED	STRAIGHT-KEY	TAPERED AND THREADED	STRAIGHT THREAD	TAPERED PIPE THREAD	FLANGE CONNECTION
	●	●	●	●	●	●				●	●			●		●	●					●			●	
●		●	●							●	●	●		●	●	●	○				●	●			●	
●		●	●	●	●	●	●	○		●	●	●	●	●		●	●	●			○	●	○		●	○
	●		●	●	●					●	●	●		●	●		●			●		●			●	
●				●	●	●	●	●	●	●	●	●		●		●	●	●			●	●	●	●	●	●
	●	●	●	●	●	●	●			●						●	●					●				●
	●	●	●	○						●	●	○		●	●	●	●				●	●		●	○	
	○	○	○	○	○	○				○	○		○	○	○	○					○	○	○	○	○	○
●						●				●	●	●		●		●				●		●		●		
	●					●				●	●					●	●					●			●	
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			●		●	●	●	●	●	●	●			●		●	●					●	●	○	●	●	●
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●		●	●	●	●	●				●	●		●	●	○	●	●					○	●	○	○	●	○
●										●	●		●	●		●			●			●			●		●

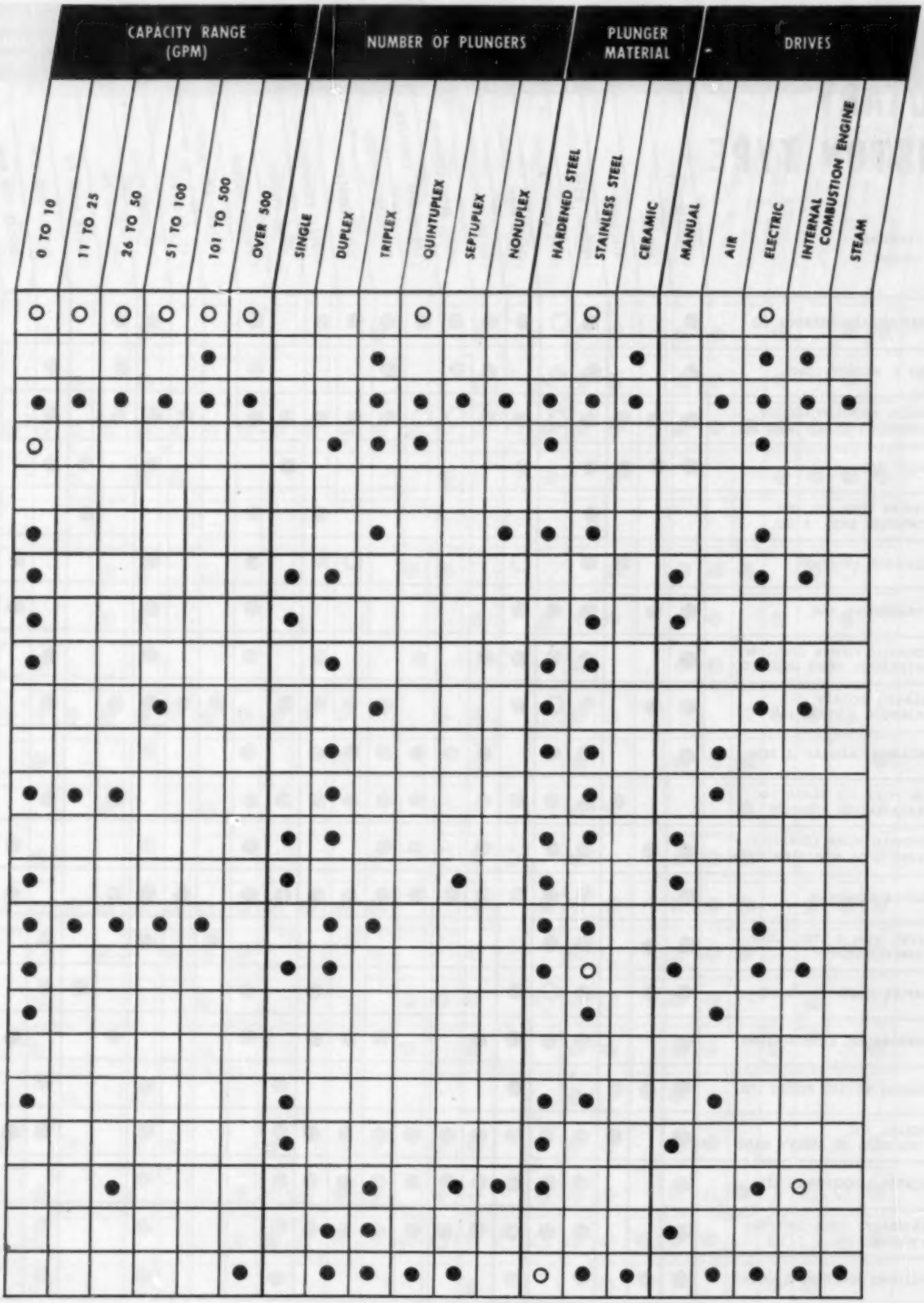
PUMPS, RECIPROCATING PLUNGER TYPE

● STANDARD
○ SPECIAL

		MEDIUM			TYPES		MAXIMUM PRESSURE							
		PETROLEUM BASE FLUIDS	FIRE-RESISTANT FLUIDS	WATER	FIXED DISPLACEMENT	VARIABLE DISPLACEMENT	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	TO 2500 PSI	TO 3000 PSI	TO 5000 PSI	TO 10,000 PSI	OVER 10,000 PSI
	AIRWAY PRODUCTS, INC.	○	○		○		○	○	○	○	○	○	○	○
	AJAX IRON WORKS	●		●	●							●		
	ALDRICH PUMP COMPANY	●	●	●	●	●							●	●
	JOHN S. BARNES CORP.	●	●		●	●						●		
	DOWTY EQUIPMENT LTD.		●								●			
*	FAWCETT-FINNEY LTD. METAL INDUSTRIES GROUP	●	●	●	●				●	●	●	●		
	GREENLEE TOOL CO. DIV. GREENLEE BROS. & CO.	●											●	
	A. L. HENDERER'S SONS	●	●	●	●		●	●	●	●	●	●	●	
	HIGH PRESSURE EQUIPMENT	●		●	●									●
	KOBE, INC.	●	●	○	●							●	●	●
*	LEDEEN MANUFACTURING CO.	●	●	●	●								●	
	ORTHO-PNEUMATIC DIVISION	●		●	●	●	●	●	●					
*	WILLIAM S. PINE COMPANY	●												●
*	POWER JACKS LTD.	●			●					●				
	ROBBINS & MYERS, INC.	●		●	●	●	●							
	RODGERS HYDRAULICS, INC.	●	○		●								●	
*	S-C HYDRAULIC ENGINEERING	●		●	●									●
*	SMITHS JACKING SYSTEMS, LTD.	●			●				●					
*	SPRAGUE ENGINEERING CORP.	●				●								●
*	STAR JACK COMPANY	●			●								●	
	TOWLER BROS, (PATENTS) LTD.	●	○		●								●	○
	K. R. WILSON, INC.	●			●							●		
	WORTHINGTON CORPORATION	●	●	●	●									●

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



PUMPS ROTARY PISTON TYPE

● STANDARD
○ SPECIAL

		USE			MEDIUM		TYPES												MAXIMUM PRESSURE RATING				MIN. SHAFT SPEED	
								VARIABLE DISPLACEMENT																
		INDUSTRIAL	MOBILE	AIRCRAFT	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	FIXED DISPLACEMENT	HAND WHEEL CONTROL	ELEC. MTR. CONTROL	SERVO MTR. CONTROL	CYLINDER CONTROL	STEM CONTROL	PRESS. COMPENSATOR	AXIAL PISTON	RADIAL PISTON	ROTARY ABUTMENT	TO 1000 PSI	TO 3000 PSI	TO 5000 PSI	OVER 5000 PSI	UNDER 200 RPM	UNDER 500 RPM
*	AMERICAN ENGINEERING CO.	●			●	○	●	●	●	●	●	●	●		●			●	●			
	JOHN S. BARNES CORP.	●			●	●		●	●		●				●				●		●	
*	DENISON ENGINEERING DIV. AMERICAN BRAKE SHOE CO.	●	●	●	●	○	●	●	○	○	●	●	●	●	●		●	●	●		●	
*	DYNEX, INC.	●	●	●	●		●							●				●		●	●	
	GREENLEE TOOL CO. DIV. GREENLEE BROS. & CO.				●								●		●					●		
	HOUDAILLE AVIATION			●	●		○					○	●		●			●				●
	HYDRAMOTIVE, INC.	●	●		●	●	●								●			●				●
*	HYDRAULIC POWER DIVISION HYDRAULIC PRESS MFG. CO.	●			●	●	●	●		●			●		●			●			●	
*	KEELAVITE ROTARY PUMPS & MOTORS LTD.	●	●		●	○	●				●	●	●	●		●	●	●	●		●	
*	BENJAMIN LASSMAN & SON	●			●	●		●	●	●	●	●	●		●			●				
*	NEW YORK AIR BRAKE CO. KALAMAZOO DIVISION			●	●	●	●	●		●	●	●	●	●	●				●		●	
	NORTHERN PUMP COMPANY SUBS'Y. OF NORTHERN ORDN.	●	●		●	●		●		●	●				●			●				●
*	OILGEAR COMPANY	●			●	●	●	●	●	●	●	●	●	●	●		●	●	●			●
	OLIVER IRON & STEEL CORP. BERRY DIVISION	●	●		●	●										●		●			●		
*	SIMPLEX ENGINEERING CO.	●	●		●	○	●						●		●					●	●	
	SUPERDRAULIC CORPORATION	●			●	●	●	●			●	●	●		●				●			●
	THOMAS SAVERY PUMPS LTD.	●	●	●			●							●				●			●		
*	VICKERS, INC. DIVISION OF SPERRY RAND	●		●	●	●	●	●	●	●	●	●	●	●				●			●	●
*	VICKERS-ARMSTRONGS LTD.	●			●	●	●	●	●	●	●	●	●	●				●				
	WATERBURY TOOL DIVISION VICKERS, INC.	●			●	●	●	●	●	●	●	●	●	●				●			●	
*	WILLIAMS MACHINE & TOOL	●	●		●		●							●				●			●	

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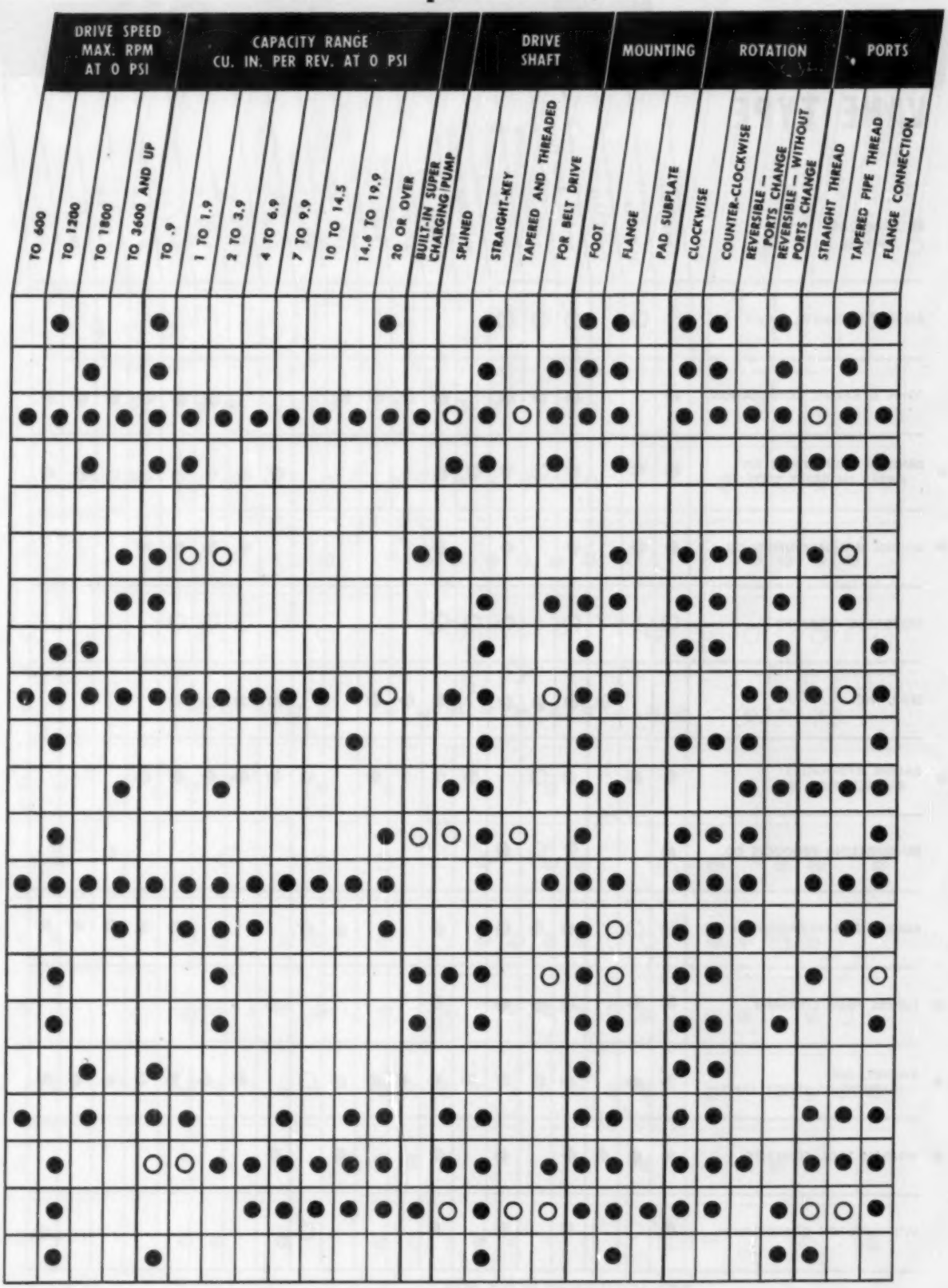
APPLIED HYDRAULICS | *fluid power component selection chart*



PUMPS
VANE TYPE

● STANDARD
○ SPECIAL

		USE				MEDIUM			TYPE							CAPACITY RANGE CU. IN. PER REV. AT 0 PSI							
		INDUSTRIAL	MOBILE	AIRCRAFT	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	FIXED DELIVERY	VARIABLE DELIVERY	SINGLE UNIT	DOUBLE UNIT (SAME SIZE)	TANDEM UNIT (LARGE AND SMALL)	TWO STAGE UNITS	DOUBLE SHAFTS	TO .2	.2 TO .9	1 TO 1.9	2 TO 3.9	4 TO 6.9	7 TO 9.9	10 TO 14.5	OVER 14.5
	AIRWAY PRODUCTS, INC.	○	○		○	○	○														
	JOHN S. BARNES CORPORATION	●			●	●	●		●	●	●	●				●	●	●	●	●	●
*	DENISON ENGINEERING DIV. AMERICAN BRAKE SHOE CO.	●	●		●	○	●	●	●					●	●	●	●	●	●	●	●
*	GRESEN MANUFACTURING CO.	●	●		●		●		●						●	●	●	●			
	HOUDAILLE AVIATION	○			○		○	○	○						○	○	○				
	LEAR, INC.			●	●	●	●		●	●	●			●	●	●	●				
*	RACINE HYDRAULICS & MACHINERY, INC.	●	●		●	○		●	●		●		●	●	●	●	●	●			
	RENGINEERING PRODUCTS CO.	●			●	○	●												●		
	ROCKWELL MANUFACTURING CO.	●	○		●	●	●		●			●	●				●	●	●	●	●
*	TUTHILL PUMP COMPANY	●	●		●	●	●		●					●							
*	VICKERS, INC. DIVISION OF SPERRY RAND	●	●		●	●	●	●	●	●	●	●	○		●	●	●	●	●	●	●
*	WELDON TOOL COMPANY	●	●	●	●		●		●			●		●							
	WORTHINGTON CORPORATION	●	○		●		●		●				○								●

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*

MAX. PRESS. RATING					ROTATION				MOUNTING			PORTS			DRIVE SPEED MAX. RPM AT 0 PSI						MIN. SHAFT SPEED		DRIVE SHAFT		
TO 500 PSI	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	OVER 2000 PSI	CLOCKWISE	COUNTER-CLOCKWISE	REVERSIBLE — PORTS CHANGE	REVERSIBLE — WITHOUT PORTS CHANGE	FLANGE	PAD — SUBPLATE	FOOT	STRAIGHT THREAD	TAPERED PIPE THREAD	FLANGE CONNECTION	TO 600 RPM	TO 1200 RPM	TO 1800 RPM	TO 3000 RPM	TO 3600 RPM	OVER 4000 RPM	UNDER 200 RPM	UNDER 500 RPM	SPLINED	STRAIGHT-KEY	TAPERED AND THREADED	FOR BELT DRIVE
	○	●	○	○																					
			●		●	●			●		●		●	●			●					●		●		
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	●		●		●	●		●	●		●	●	●	●	●	●	●	●	●		●		●	●	●	●
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●					●	●		●			●	●		●	●						●			●		●

SWITCHES, LIMIT

● STANDARD
○ SPECIAL

	USE			ELECT. RATING				FORK TYPE					ROTARY TYPE				
				110V AC			110V DC	OPER		CONTACTS			CONT'S		MAX. TURNS SHAFT		
	INDUSTRIAL	MOBILE	AIRCRAFT	5 AMP	10 AMP	2.5 AMP	10 AMP	SLOW-ACTION, MAINTAINED	SNAP-ACTION, MAINTAINED	1 N.O.	1 N.C.	1 N.O. AND 1 N.C.	2 N.O. AND 2 N.C.	2 N.C.	0 TO 30 REV.	30 TO 120 REV.	CONTINUOUS ROTATION
ACRO MANUFACTURING CO.	●	●	●	●	●	●	●										
ALLEN-BRADLEY COMPANY	●								●			●					
* THE BELLOWS COMPANY	●				●		●										
CLARK CONTROLLER COMPANY	●				●			●	●	●	●	●	●	●			●
CONTROL PRODUCTS, INC.	●	●			●		●										
* R. B. DENISON MFG. CO.	●				●		●	●	●			●					
* ELECTRO-SNAP SWITCH & MANUFACTURING COMPANY	●		●	●	●	●	●		●	●	●	●					
FURNAS ELECTRIC COMPANY	●			●	●								●	●	●	●	
GEMCO ELECTRIC COMPANY	●			●	●								○	●	●	●	●
GENERAL ELECTRIC COMPANY	●				●		●		●			●	●	●	●	●	
MERCOID CORPORATION	●			●	●												
MICRO SWITCH DIVISION MINNEAPOLIS-HONEYWELL	●	●	●		●												
NATIONAL ACME COMPANY	●				●		●										
SORENG PRODUCTS CORPORATION	●				○								○	○			
SQUARE D COMPANY	●			●	●	●	●										
UNIMAX DIVISION W. L. MAXSON CORP.	●		●	●	●	●	●										

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ROLLER LEVER TYPE														PUSH ROD TYPE								SPECIAL ENCLOSURE			
OPERATION						CONTACTS								OPERATION				CONTACTS							
SLOW-ACTION, SPRING RETURN	SNAP-ACTION, SPRING RETURN	SLOW-ACTION, MAINTAINED	SNAP-ACTION, MAINTAINED	SPRING-RETURN TO CENTER	1 N.O.	1 N.C.	1 N.O. AND 1 N.C.	2 N.O.	2 N.C.	2 N.O. AND 2 N.C.	SLOW-ACTION, SPRING RETURN	SNAP-ACTION, SPRING RETURN	SLOW-ACTION, MAINTAINED	SNAP-ACTION, MAINTAINED	1 N.O.	1 N.C.	1 N.O. AND 1 N.C.	WATER AND DUST TIGHT	OIL TIGHT	EXPLOSION PROOF	HERMETICALLY SEALED
	●		●		●	●	●	●	●	●		●		●	●	●	●	●	●	●	
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	●				●	●	●					●			●	●	●	●	●		

SWITCHES, PRESSURE

● STANDARD
○ SPECIAL

		USE				MEDIUM			TYPE			MIN. DIFFERENTIAL PSI						PRESSURE CONNECTION				
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	HYDRAULIC OIL	DIAPHRAGM	BELLOWS	PISTON	BOURDON TUBE	.5 TO 5	5 TO 25	25 TO 100	100 TO 500	500 TO 1000	OVER 1000	⅛ INCH PIPE	¼ INCH PIPE	⅜ INCH PIPE	½ INCH PIPE	TUBING
	AIRCRAFT CONTROLS, COMPANY DIVISION OF GORN ELECTRIC	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	○	○	○
	ALLEN-BRADLEY COMPANY	●			●	●	●	●			●	●	●					●		●	
*	ALLOY BELLOWS ENGR'G. CO.	●		●	●	●			●								●				
	AUTOMATIC TEMPERATURE CONTROL	●				●				●				●				●			
*	BARKSDALE VALVE COMPANY	●	●		●	●	●		●	●	●	●	●	●	●	●	○	●	○	○	●
	CORNELIUS COMPANY			●	●	●	●	●	●	●	●										●
	ELECTROL, INC.			●		●			●				●				●	●	●		
*	FAWCETT-FINNEY LTD. METAL INDUSTRIES GROUP	●	●		●	●	●							●			●				
	FURNAS ELECTRIC COMPANY	●			●		●				●	●	●				●	●	●		●
	GENERAL CONTROLS COMPANY	●	●	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●	●
	GENERAL ELECTRIC COMPANY	●			●	●	●			●	●						●	●			
*	HYDRAULIC POWER DIVISION HYDRAULIC PRESS MFG. CO.	●				●			●				●						●		
	HYDRAULIC RESEARCH & MANUFACTURING COMPANY			●	●	●			●				●	●	●	●					●
*	WALTER KIDDE & COMPANY			●	●		●														●
*	BENJAMIN LASSMAN & SON	●				●			●			●							●		
	LEACH CORPORATION	○	●	●	●	●	○		●				●	●			○	○			●
	LEAR, INC.			●	●			●			●						●				●
	J. E. LONERGAN COMPANY	●			●	●				●		●						●		●	
	MELETRON CORPORATION			●	●	●	●			●	●	●	●	●	●	●	●	●			●
	MERCOID CORPORATION	●			●		●			●	●	●	●	●	●	●		●			●
	OIL-DYNE, INC.	●	●	●	●	●			●			●	●	●			●				○
	ROCHESTER MFG. CO., INC.	○	●	●	●	●	●										●	●			
	SORENG PRODUCTS CORP.	○																			
	SQUARE D COMPANY	●			●	●		●	●		●	●	●	●					●		
	TAVCO, INC.			●	●	●			●				●	●				●			
	UNITED ELECTRIC CONTROLS CO.	●	●	●	●	●		●			●	●	●				●	●	●	●	
*	VICKERS, INC. DIVISION OF SPERRY RAND	●				●			●				●					●			

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APPLIED HYDRAULICS | *fluid power component selection chart*

MIN. LOW PRESS. ADJUSTMENT (DEACTUATION) PSI							MAX. HIGH-PRESS. ADJUSTMENT (ACTUATION) PSI							CONTACT OPERATION				CONTACT RATING (CONTINUOUS)			SPECIAL ENCLOSURE			
.5 TO 20	20 TO 100	100 TO 500	500 TO 1000	1000 TO 2500	OVER 2500	10 TO 50	50 TO 250	250 TO 500	500 TO 1500	1500 TO 3000	3000 TO 5000	5000 TO 10,000	N.O. CLOSES AT HIGH SET	N.C. OPENS AT HIGH SET	MANUAL RESET	ADJUSTABLE DIFFERENTIAL	10 AMPS 110V AC	15 AMPS 110V AC	.5 AMPS 115V DC	WATER AND DUST TIGHT	OIL TIGHT	EXPLOSION-PROOF	HERMETICALLY SEALED
●	●	●	●	●	●	●	●	●	●	●	○	●	●	○	●	●	●	●	●	●	●	●	○
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TIMERS, ELECTRIC

● STANDARD
○ SPECIAL

	USE		REPEAT ACCURACY % FULL SCALE				ELECTRONIC					PNEUMATIC							
							MIN. SETTING	MAX. SETTING				MIN. SETTING	MAX. SETTING	FEATURES					
	INDUSTRIAL	AIRCRAFT	1 TO 1	1 TO 5	5 TO 10	OVER 10	.025 SEC.	.045 SEC.	2 MIN.	3 MIN.	WARM-UP TIME REQUIRED INCLUDES VOLTAGE REGULATOR	LESS THAN .2 SEC.	.2 SEC. TO 1 SEC.	3 TO 10 MIN.	10 TO 15 MIN.	ON DELAY	OFF DELAY	ON AND OFF DELAY	DIAL INDICATOR	AIR INTAKE FILTER
ALLEN-BRADLEY COMPANY	●								●		●	●				●	●	●		●
AUTOMATIC ELECTRIC MFG. CO.	●	●																		
AUTOMATIC TEMPERATURE CONTROL	●		●	●			●				●		●		●	●	●	●	○	
* THE BELLOWS COMPANY	●			●			●			●	●	●	●			●	●		●	●
BURKLYN COMPANY	●			●			●				●									
CRAMER CONTROLS CORP.	●	●	●																	
CUTLER-HAMMER, INC.	●			●			●		●		●		●	●		●	●			
DIMCO-GRAY COMPANY	●		●																	
* EAGLE SIGNAL CORPORATION	●	●	●				●	●	●		●		●			●	●			●
ELASTIC STOP NUT AGA STAT. DIVISION	●											●		●	●	●	●	●	●	○
EMMETT MACHINE COMPANY	●		●																	
G-V CONTROLS, INC.	●	●		●				●		●										
GENERAL ELECTRIC	●		●									●	●			●	●			●
THE A. W. HAYDON COMPANY	●	●	●	●	●	●														
HAYDON MANUFACTURING CO.	●	●		●																
INDUSTRIAL TIMER COMPANY	●		●																	
M. H. RHODES, INC.	●	●		●	●															
SEELY INSTRUMENT COMPANY	●		●																	
G. C. WILSON & COMPANY	●	●	●	●	●		●			●	●	●								

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MOTOR																					OIL DASHPOT			SPECIAL ENCLOSURE			
AUTOMATIC RESET													REPEAT CYCLE														
MIN. SETTING				MAX. SETTING				CONTACTS					MIN. SETTING				MAX. SETTING				MIN. SETTING	MAX. SETTING	RESET TIME				
LESS THAN ¼ SEC.	¼ TO 1 SEC.	1 TO 3 SEC.	10 SEC. TO 5 MIN.	5 TO 100 MIN.	100 MIN. TO 5 HRS.	OVER 5 HRS.	1 DPDT	1 SPDT	1 TO 3 SPST	3 TO 11 SPST	LESS THAN 1 SEC.	1 TO 15 SEC.	15 TO 60 SEC.	60 SEC. TO 10 MIN.	1 TO 5 HRS.	OVER 5 HRS.	2 SEC.	.5 SEC.	30 SEC.	60 SEC.	.5 SEC.	OVER .5 SEC.	WATER AND DUST TIGHT	OIL TIGHT	EXPLOSION PROOF	HERMETICALLY SEALED
																		●		●		●		●		●	
		●	●	●	●	●	○	●	○	○		●	●	●	●	●											
●	●	●	●	●	●	●	●	●	●	●		●			●	●							●	●	●	○	
		●		●			●		●		●				●												
●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●							●			●	
												●	●	●	●	●											
●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●							●	●	●	○	
																							○	○	○	●	
		●	●	●	●	●	●	●	●	●																	
																							●			●	
●						●		●															●		●		
	●					○	●	●	●	●	●					●							●	●	●	●	
●	●	●	●	●	●	●	○	●	○		●	●	●	●	●	●										●	
●			●			●		●	●	●	●	●			●	●										●	
			●	●	●	●	●	●	●			●	●	●		●											
	●					●	●					●			●	●							●		○		
											●	●	●										●	●	●	●	

VALVES, DIRECTIONAL CONTROL

● STANDARD
○ SPECIAL

		USE				MEDIUM				OPERATION										MOUNTING					
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	WATER	HAND LEVER	FOOT TREADLE	STEM	ROLLER OR CAM	PILOT	DIRECT SOLENOID	SOLENOID PILOT-OPER.	SERVO	TIME DELAY	FOOT BASE THREADED PORTS	FOOT BASE FLANGE PORTS	LINE MOUNTED THREADED PORTS	LINE MOUNTED FLANGE PORTS	SUBPLATE – GASKET	
	ACCESSORY PRODUCTS COMPANY	●	●	●	●				●			●		●						●	●		
*	ADEL PRECISION PRODUCTS DIV. GENERAL METALS CORP.	●			●				●	●		●	●	●				●		●			
	AIRCRAFT PRODUCTS COMPANY			●	●	●			●		●	●	●	●	●			●		●			
	AIRMATIC VALVES, INC.	●			●			●	●	●	●	●	●	●	●		●	●	●	●	●	●	●
	AIRWAY PRODUCTS, INC.	○	○	○		●	●		●	○	○	○	○	●	●	○	○	○	●	○	●	●	
	A. K. ALLEN COMPANY	●	●		●				●	●		●	●	●	●		●	●					●
*	ALMAR HYDRAULIC VALVE CO.	○				○	○	○	○			○	○	○							○		
	ALTAIR, INC.			●	○	○			○			○	○	○	○					●	○	○	
	AMERICAN INDUSTRIES CO.	○	○			○	○		○		○	○						○	○	○			
*	ANCHOR COUPLING CO.	●	●			●												●		●			
	ANKER-HOLTH DIVISION WELLMAN ENGINEERING CO.	●			●				●	●		●	●	●	●			●					
*	ATKOMATIC VALVE COMPANY	●	●		●	●	●	●						●	●					●			
*	AUTOMATIC SWITCH COMPANY	●	●		●	●	○	●					●	●	●		●		○	●	●	●	●
*	AUTOMATIC VALVE COMPANY	●			●				●		●	●	●	●	●			●		●			●
*	JOHN D. BACHMAN & COMPANY	●			●	●	●	●			●		●	●						●			●
*	BARKSDALE VALVE COMPANY	●	●		●	●	●	●	●	●		○	●	●	●			●		●			●
	JOHN S. BARNES CORP.	●				●	●		●	●	●	●	●	●	●			●	●	●			●
*	BECKETT-HARCUM COMPANY	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				●
*	THE BELLOWS COMPANY	●			●				●	●	●	●	●	●	●		●	●		●			
*	BENDIX AVIATION CORPORATION PACIFIC DIVISION			●		●	●		●			○	●	●	●	●		●	○	●	○	●	
	BALDWIN INSTRUMENT CO., LTD.	●	●		●	●	●	●	●	●	●	●	●		●			●					
	BURKLYN COMPANY	●			●																		
	CADILLAC GAGE COMPANY			●		●	●								●	●							
*	CARTER CONTROLS, INC.	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●
*	CHAR-LYNN COMPANY	●	●	●	●	●	●		●		●							●		●			
*	CIRCLE SEAL PRODUCTS CO.	●	●		●	●	●	●	●											●			
	CLARK CONTROLLER COMPANY	●			●									●	●			●		●			

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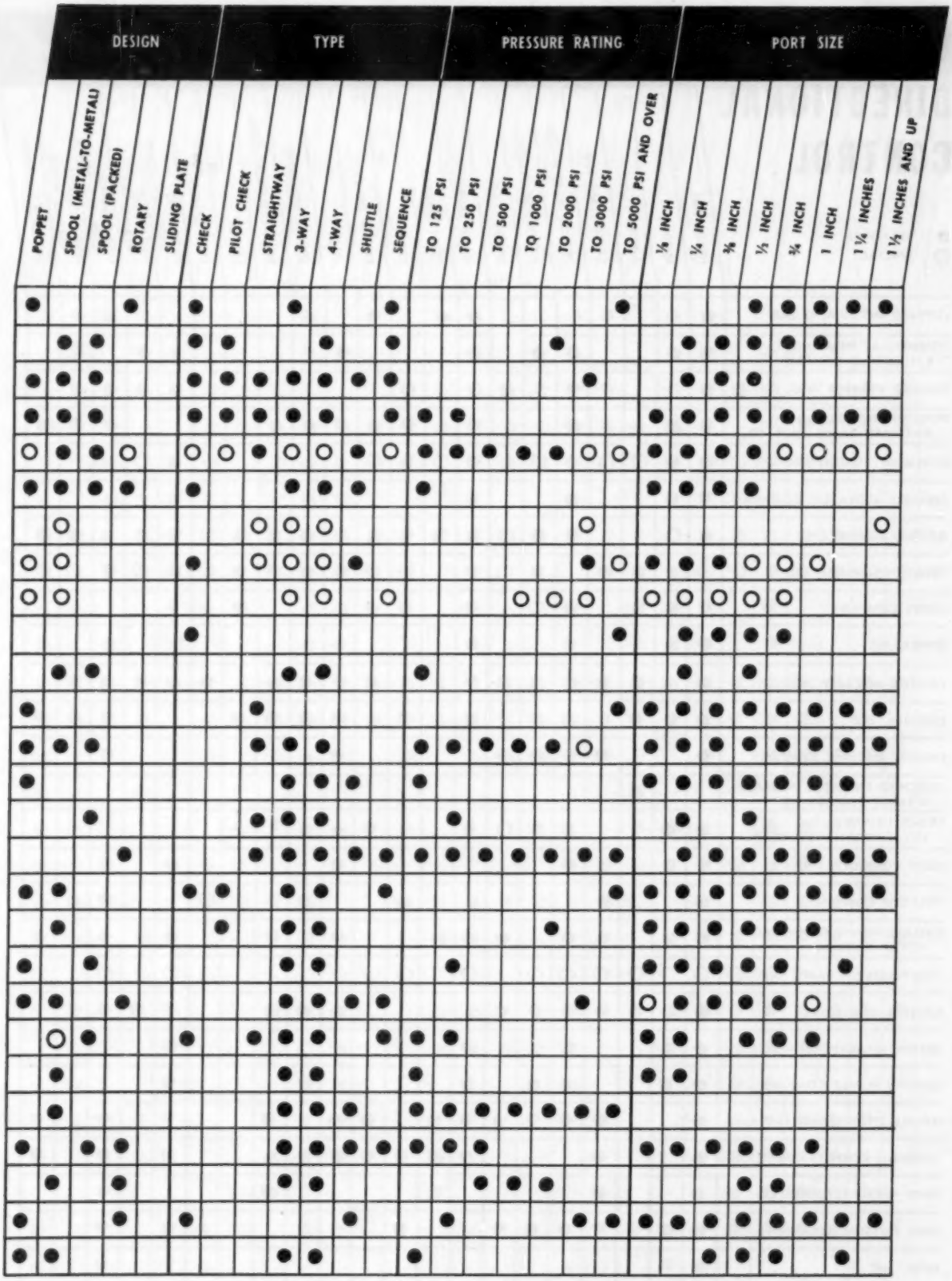
APPLIED HYDRAULICS | *fluid power component selection chart*



VALVES, DIRECTIONAL CONTROL

● STANDARD
○ SPECIAL

		USE				MEDIUM				OPERATION										MOUNTING					
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	WATER	HAND LEVER	FOOT TREADLE	STEM	ROLLER OR CAM	PILOT	DIRECT SOLENOID	SOLENOID PILOT-OPER.	SERVO	TIME DELAY	FOOT BASE THREADED PORTS	FOOT BASE FLANGE PORTS	LINE MOUNTED THREADED PORTS	LINE MOUNTED FLANGE PORTS	SUBPLATE — GASKET	
	CLIPPARD INSTRUMENT LAB.	●			●				●	●		●								●	●			
*	COMMERCIAL SHEARING & STAMPING COMPANY	●	●			●	●		●				●					●	●					
*	DARLING VALVE & MFG. CO.	●				●		●	●		●							●	●	●	●			
*	DENISON ENGINEERING DIV. AMERICAN BRAKE SHOE CO.	●	●			●			●		●	●	●	●	●					●	●	●		
*	DENSMORE ENGINEERING CO.	●	●	○	○	●	○		●	○	●	○						●	○					
	DONNELL HYDRAULIC COMPANY	●	●			●			●									●						
*	DOUBLE A PRODUCTS	●	○			●	●	○	●	●	●	●	●	●	●	●	○	●	●	●	●	●		
	DOWTY EQUIPMENT LTD.			●	●		●	○	●		○	○	●	●	●	●	○	●	○	●	○	○		
	DUKES COMPANY	●	●	●		●	○		●		●	●				●		●						
*	DYNEX, INC.	●	●			●			●											●				
	EASTERN AIRCRAFT PRODUCTS	●		●	●	●	●	●	●			●	●	●	●		●	●	●	●	●			
	ELECTROL, INC.	●	●	●		●	●		●		●		●	●	●	●				●	●	●		
	EMMETT MACHINE COMPANY	●			●	●	●	●					●							●				
*	FAIRCHILD ENGINE & AIRPLANE STRATOS DIVISION			●																				
*	FAWCETT-FINNEY LTD. METAL INDUSTRIES GROUP	●	●			●	●	○	●			●	●	●										
*	FLUID CONTROLS, INC.	●	●			●							●					●		●				
	FOXBORO COMPANY	●			●						●			●	●		○			●	●			
*	GALLAND-HENNING MFG. CO. NOPAK DIVISION	●	●		●	●		●	●	●			●		●			●		●		●		
*	GAR PRECISION PARTS, INC.	○		○	○	○	○		○		○							○		○				
	GENERAL CONTROLS	●	●	●	●	●	●	●					●	●	●			●	●	●				
*	GRESEN MANUFACTURING CO.	●	●			●			●									●						
	GROBAN SUPPLY COMPANY	●	●			●	●		●									●						
*	HANNA ENGINEERING WORKS	●			●	●	●	●	●	●		●	●		●			●		●		●		
	HANNIFIN CORPORATION	●			●				●	●	●	●	●	●	●			●		●		●		
	HAYS MANUFACTURING CO.	●			●										●					●				
	HIGH PRESSURE EQUIPMENT	●	●		●	●	●	●			●							●		●				
*	HOKE, INC.	●																		●				

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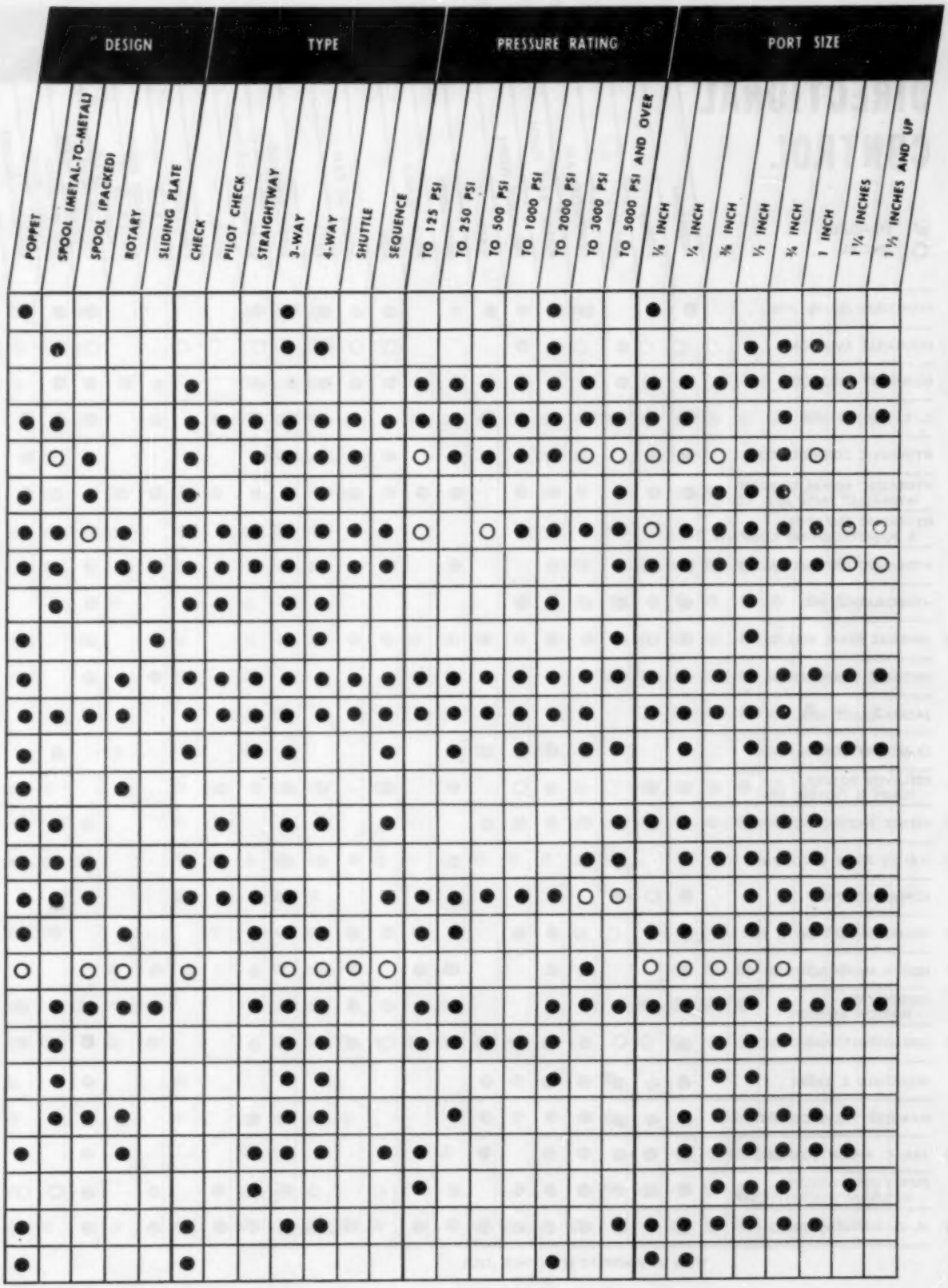

DESIGN
TYPE
PRESSURE RATING
PORT SIZE
POPPET
SPOOL (METAL-TO-METAL)
SPOOL (PACKED)
ROTARY
SLIDING PLATE
CHECK
PILOT CHECK
STRAIGHTWAY
3-WAY
4-WAY
SHUTTLE
SEQUENCE
TO 125 PSI
TO 250 PSI
TO 500 PSI
TO 1000 PSI
TO 2000 PSI
TO 3000 PSI
TO 5000 PSI AND OVER
⅛ INCH
¼ INCH
⅜ INCH
½ INCH
¾ INCH
1 INCH
1¼ INCHES
1½ INCHES AND UP

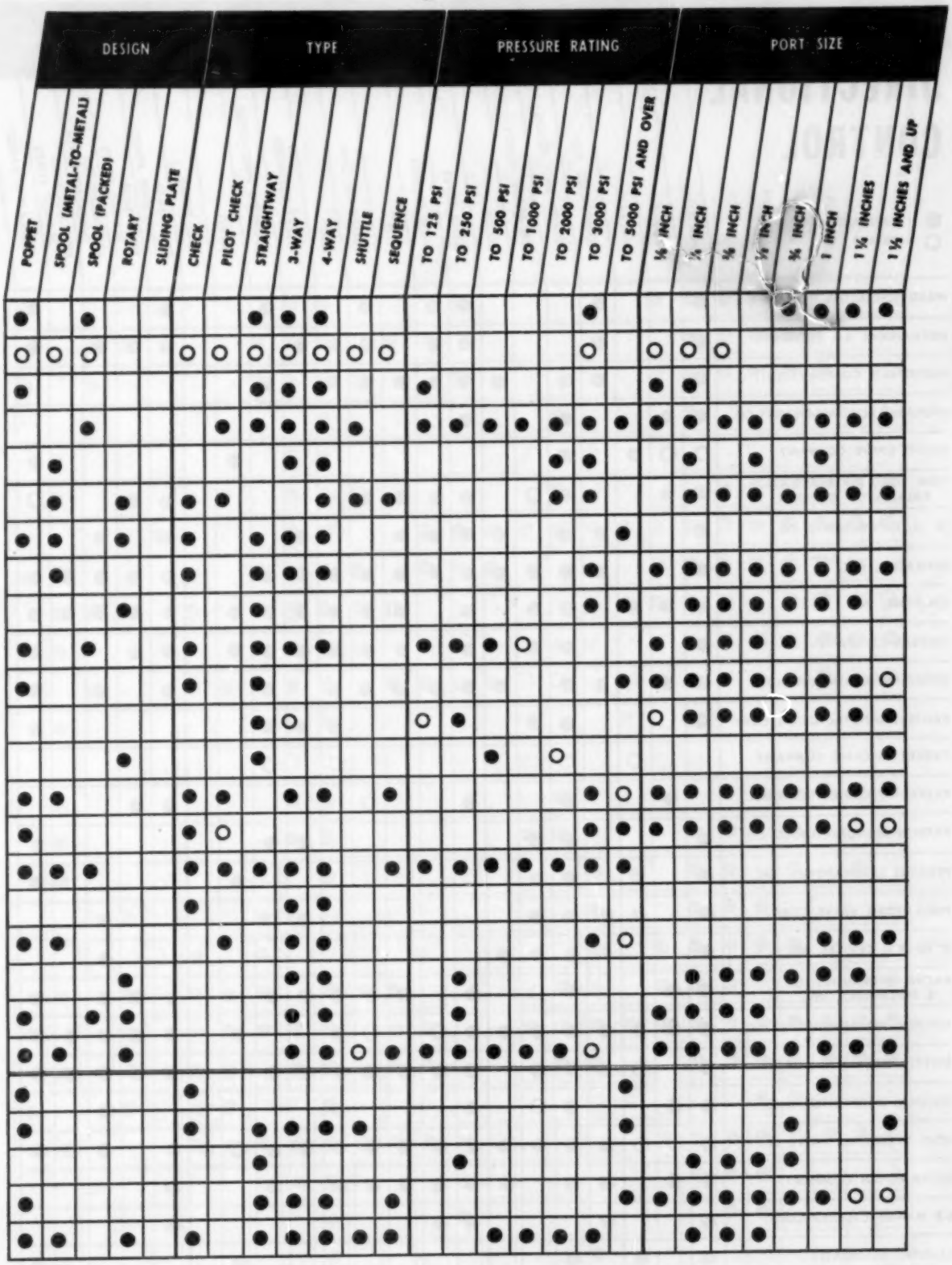
VALVES, DIRECTIONAL CONTROL

● STANDARD
○ SPECIAL

		USE				MEDIUM					OPERATION										MOUNTING				
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL BASE FLUIDS	FIRE-RESIST. FLUIDS	WATER	HAND LEVER	FOOT TREADLE	STEM	ROLLER OR CAM	PILOT	DIRECT SOLENOID	SOLENOID PILOT-OPER.	SERVO	TIME DELAY	FOOT BASE THREADED PORTS	FOOT BASE FLANGE PORTS	LINE MOUNTED THREADED PORTS	LINE MOUNTED FLANGE PORTS	SUBPLATE – GASKET
	HOMESTEAD VALVE MFG.	●			●	●	●	●	●		●	●	●	●	●					●	●	●
	HOUDAILLE AVIATION			●		●	●				○	○	○		○					○	○	
	HUMPHREY PRODUCTS	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●	●	●	
*	C. B. HUNT & SON	●			●	●	●	●	●	●	●	●	●	●	●			●		●	●	●
	HYDRAULIC CONTROLS CO.	●	●			●	●				●	●	●	●	●							●
*	HYDRAULIC POWER DIVISION HYDRAULIC PRESS MFG. CO.	●	●			●	●		●	●	●	●	●	●	●			●	●	●	●	●
	HYDRAULIC RESEARCH & MANUFACTURING COMPANY			●		●						●	●	●	●	●				●		
	HYDRAULIC UNIT SPECIALTIES	●	●			●			●		●							●		●		
	HYDROMATICS, INC.	●	●	●	●	●	●							●						●		
*	IMPERIAL BRASS MFG. CO.	●	●	●	●	●	●	●	●		●	●						●		●		
	INTEGRAL CORPORATION	●	●	●	●	●	●											●		●		
	JACKES-EVANS MFG. CO.	●	●		●	●	●	●						○	●					●		
	JAMESBURY CORPORATION	●			●	●	●	●	●						●						●	
*	KEELAVITE ROTARY PUMPS & MOTORS LTD.	●	●			●	○		●		●		●	●	●	●						
*	KEPNER PRODUCTS COMPANY	●	●	●	●	●	●	●					○							●	○	
*	WALTER KIDDE & COMPANY			●	●				●			●	●	●		●				●		
	KOHLER COMPANY	●	○	●											●							
*	BENJAMIN LASSMAN & SON	●				●	●		●	●	●	●	●								●	
*	LEDEEN MANUFACTURING CO.	●			●	●			●	●		●	●		●		●	●				
	LEHIGH, INC. MARTON DIVISION	●			●				●	●	●	●	●	●	●			●				●
*	LOGANSPORT MACHINE CO.	●		○	●	●	●	●	●	●	○	●	●	●	●			●		●		●
	MANSFIELD & GREEN	●	●	●	●	●	●	●												●		
	MAROTTA VALVE CORPORATION	●	●	●	●	●	●	●	●				●	●	●				●	●		
*	JAS. P. MARSH CORPORATION	●	●	●	●	●		●						●	●					●		
	MAR VISTA DIVISION NATIONAL AIRCRAFT CORP.	●	●	●	●	●	●		●					●	●	●		●		●	○	○
*	M. C. MANUFACTURING CO.	●		●	●	●	●	●	●	●		●	●	●	●	●		●		●		

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



VALVES, DIRECTIONAL CONTROL

● STANDARD
○ SPECIAL

		USE				MEDIUM				OPERATION										MOUNTING				
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	WATER	HAND LEVER	FOOT TREADLE	STEM	ROLLER OR CAM	PILOT	DIRECT SOLENOID	SOLENOID PILOT-OPER.	SERVO	TIME DELAY	FOOT BASE THREADED PORTS	FOOT BASE FLANGE PORTS	LINE MOUNTED THREADED PORTS	LINE MOUNTED FLANGE PORTS	SUBPLATE – GASKET
*	MEAD SPECIALTIES COMPANY	●			●				●	●		●			●			●				●
*	MECHANICAL AIR CONTROLS	●			●				●	●		●	●	●				●	●	●		●
*	MODERNAIR CORPORATION	●			●	●		●	●	●	●	●	●		●							
*	MONARCH ROAD MACHINERY CO.	●	●			●			●													
*	MOOG VALVE COMPANY	○	○	●		●										●						●
*	NEW YORK AIR BRAKE CO. KALAMAZOO DIVISION	●	●			●	○		●	●	●	●						●	●			○
	W. H. NICHOLSON & CO.	●			●	●		●	●	●	●			●				●		●		
*	NUMATICS, INC.	●			●	●	●	●	●	●	●	●	●	●	●			●	●	●	●	●
	OIL-DYNE, INC.	●	●	●		●	●		●		●	●	●	●	●	●		●	●	●	●	●
*	OILGEAR COMPANY	●				●	●		●		●	●	●	●	●	●		●	●			●
	ORTHO-PNEUMATIC DIVISION	●	●		●	●		●	●	●	●	●	●		●			●		●		●
	PANTEX MANUFACTURING CORP.	●				●	●						●	●	●							●
	PARKER AIRCRAFT COMPANY			○		○							○		○							
*	PARKER APPLIANCE COMPANY		●			●			●			○						●	●			
*	PATHON MANUFACTURING CO.	●				●	●							●	●							●
	PEGASUS LABORATORIES, INC.	●		●		●	●									●						●
	PNEU-HYDRO VALVE CORP.	●		●	●	●	●							●						●		
*	PNEU-TROL DEVICES, INC.	●			●	●	●	●												●		
*	RACINE HYDRAULICS & MACHINERY, INC.	●	●			●	○		●		●	●	●	●	●			●	●	●		●
*	REPUBLIC MANUFACTURING CO.	●	●	●	●	●	●	●	●	○		○	●			●		●	●	●	●	●
*	RIVETT, INC.	●		○	●	●	●		●	●	●	●	●	●	●			●	●	●	●	●
	RODGERS HYDRAULICS, INC.	●	●			●	○		●				●							●		
	ROSS OPERATING VALVE CO.	●	○	○	●	●	●	●	●	●	●	●	●	●	●	○	●	●		●	○	●
	ROTEX PUNCH COMPANY	●	●		●	●		●	●	●	●	●	●		●			●				
*	S-P MANUFACTURING CORP.	●			●				●	●								●				
*	SANDERS ASSOCIATES	●		●		●										●						●

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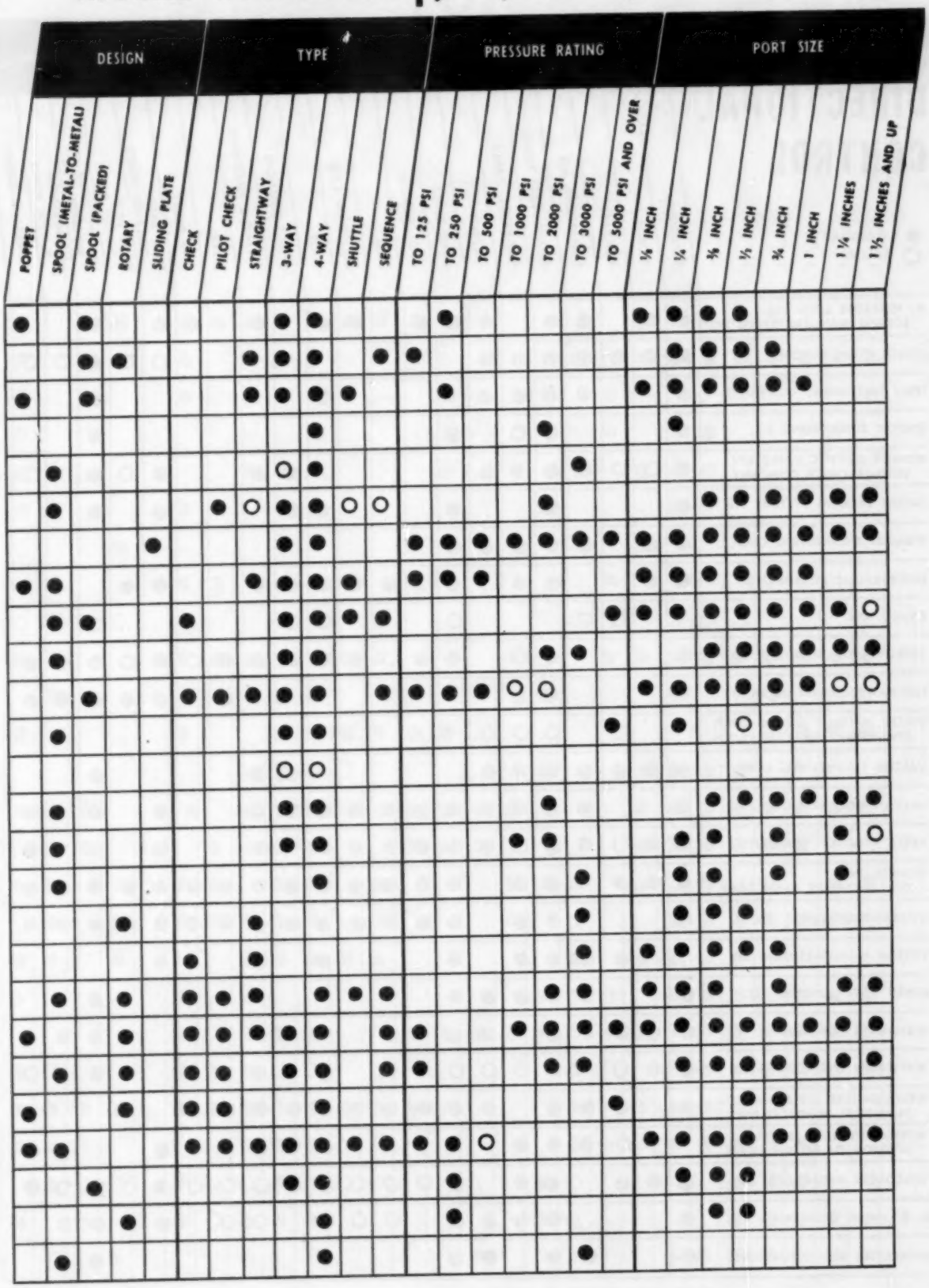
DESIGN
TYPE
PRESSURE RATING
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POPPET
SPOOL (METAL-TO-METAL)
SPOOL (PACKED)
ROTARY
SLIDING PLATE
CHECK
PILOT CHECK
STRAIGHTWAY
3-WAY
4-WAY
SHUTTLE
SEQUENCE
TO 125 PSI
TO 250 PSI
TO 500 PSI
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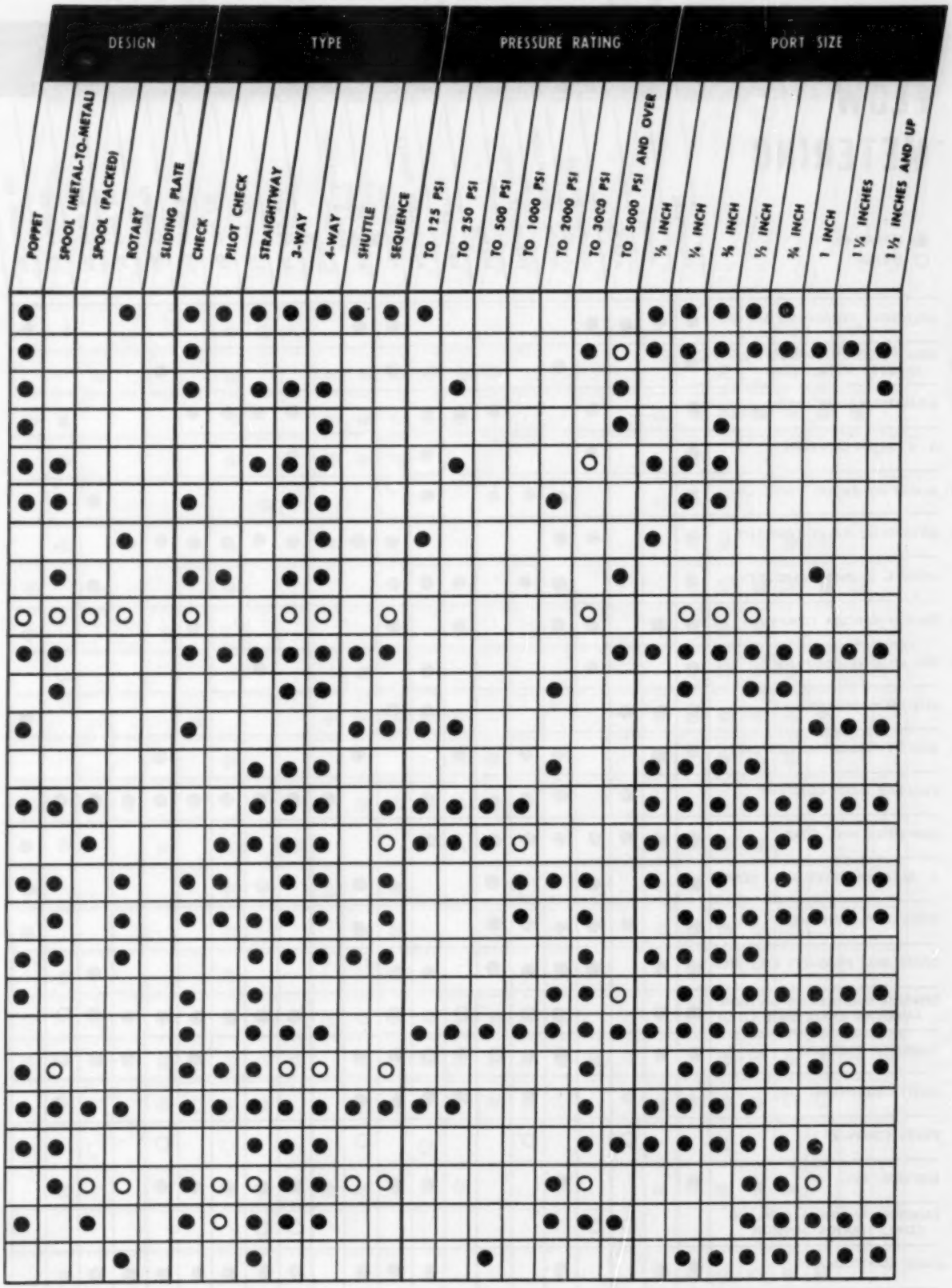
VALVES, DIRECTIONAL CONTROL

● STANDARD
○ SPECIAL

		USE				MEDIUM				OPERATION									MOUNTING					
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	WATER	HAND LEVER	FOOT TREADLE	STEM	ROLLER OR CAM	PILOT	DIRECT SOLENOID	SOLENOID PILOT-OPER.	SERVO	TIME DELAY	FOOT BASE THREADED PORTS	FOOT BASE FLANGE PORTS	LINE MOUNTED THREADED PORTS	LINE MOUNTED FLANGE PORTS	SUBPLATE – GASKET	
*	A. SCHRADER SONS DIV. SCOVILL MANUFACTURING CO.	●	●		●	●		●	●	●		●	●		●		●	●		●			
*	SEALOL CORPORATION	●	●	●	●	●	●	●										○	○	●	○	○	
	SEELY INSTRUMENT COMPANY	●			●	●	●	●					●							●			
*	SIMPLEX ENGINEERING CO.	●				●	○		●											●			
*	SKINNER ELECTRIC VALVE DIV. SKINNER CHUCK COMPANY	●	○	○	●	●	●	●						●	●			●	○	●		○	
*	SMITHS JACKING SYSTEMS LTD.	●				●			●				●	●				●		●			
*	SPRAGUE ENGINEERING CORP.	●	●		●	●	●	●	●														
	SUPERDRAULIC CORPORATION	●	●			●	●		●		●	●	●	●	●			●	●				
	TAVCO, INC.			○	○				○				○	○						○			
	TOWLER BROS. (PATENTS) LTD.	●				●	○		●	●	○	●	●	●	●	●	○	●	○	●	○	●	
	TURCHAN FOLLOWER MACHINE CO.	●				●	●									●		●	●	●	●	●	
*	UNITED METALLIC O-RING CORP. DIV. UNITED AIRCRAFT PRODS.			○		○	○	○															
	VALCOR ENGINEERING CORP.	●	●	●	●	●	●	●						●	●					●			
	VALVAIR CORPORATION	●			●	●	●	●	●	●	●	●	●	●	●		●	●		●		●	
	VERSA PRODUCTS COMPANY	●	●	○	●	●	○	●	●	●	●	●	●		●			●		●		●	
*	VICKERS, INC. DIV. OF SPERRY RAND CORP.	●	●	●		●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	
*	VICKERS-ARMSTRONGS LTD.	●				●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	
	VINSON MANUFACTURING CO.			●	●	●	●		●				●		●			●					
*	HENRY VOGT MACHINE CO.	●			●	●	●	●	●											●			
	WALWORTH COMPANY	●	●	●	●	●		●	●		●									●	●		
*	WATERMAN ENGINEERING CO.	●	●	○		●	○	○	○				○		●					●		○	
	WESTINGHOUSE AIR BRAKE CO. INDUSTRIAL PRODUCTS DIV.	●		●	●	●		●	●	●	●	●	●	●	●	●							
	WESTON HYDRAULICS LTD. DIVISION OF BORG-WARNER			○	●	●	●						●	●	●	●		●				●	
	WISCONSIN HYDRAULICS, INC.	●	●	●		●	●		●	○	○	○	○	○	○	○	○	●	○	○	○	●	
	R. D. WOOD COMPANY	●				●	●	●	●		○	○	○		○	○		●	●	●	●		
*	WORCESTER VALVE COMPANY	●			●	●		●	●											●			

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



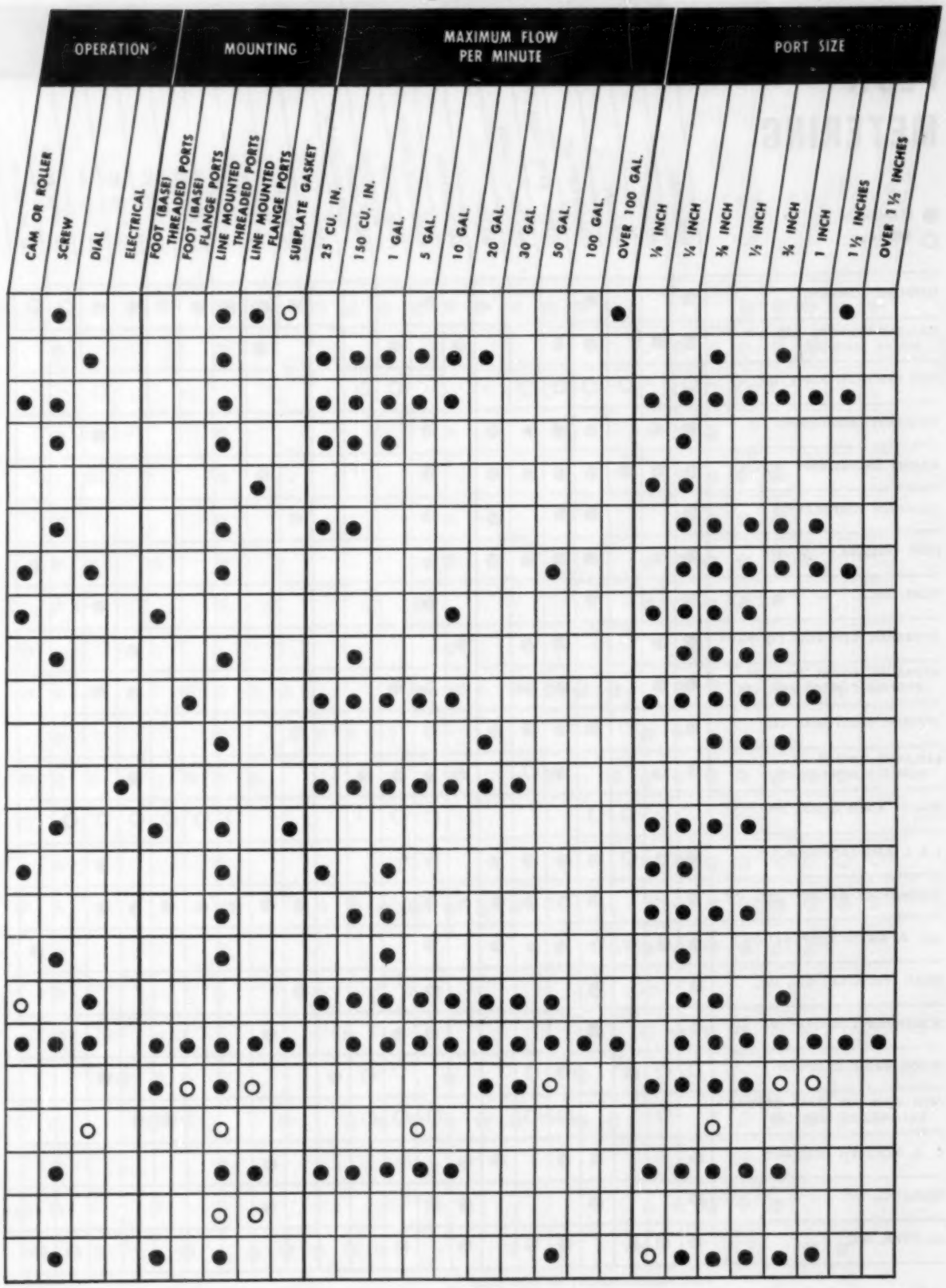
VALVES, FLOW METERING

● STANDARD
○ SPECIAL

		USE				MEDIUM				TYPE					PRESSURE RATINGS								
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	WATER	DECELERATION	ADJUSTABLE ORIFICE	PRESS. COMP. ADJUSTABLE	PRESS. COMP. NON-ADJUSTABLE	SERVO	TO 125 PSI	TO 250 PSI	TO 750 PSI	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	TO 3000 PSI	TO 5000 PSI	TO 10,000 PSI
	ACCESSORY PRODUCTS COMPANY	●	●	●	●						●	●											●
*	ADEL PRECISION PRODUCTS DIV. GENERAL METALS CORP.	●				●					●							●					
	AIRMATIC VALVES, INC.	●			●			●	●	●				●	●	●	●						
	A. K. ALLEN COMPANY	●			●					●				●									
*	ALMAR HYDRAULIC VALVE CO.	●				●	●	●		●										●			
*	AUTOMATIC VALVE COMPANY	●			●	●					●	●		●	●	●	●	●	●				
	JOHN S. BARNES CORPORATION	●				●	●		●	●	●									●			
*	BECKETT-HARCUM COMPANY	●	●		●	●			●		●						●						
*	THE BELLOWS COMPANY	●			●					●					●								
	BENTON CORPORATION	●	●	●						●	●												●
*	BENTON HARBOR ENG'RG WORKS	●	●			●	●		●			●						●					
	CADILLAC GAGE COMPANY			●		●	●			●			●	●	●	●	●	●	●	●	●		
	CARPENTER MFG. CORP.	●	●	●	●	●	●	●		●													●
	A. W. CASH VALVE MFG. CORP.	●			●			●				●			●								
	CHEMIQUIP COMPANY	●		●	●	●	●	●				●											●
*	CIRCLE SEAL PRODUCTS CO., INC.	●	●		●	●	●	●		●										●			
*	DENISON ENGINEERING DIVISION AMERICAN BRAKE SHOE CO.	●	●			●	○		○		●			●	●	●	●	●	●	●	●	○		
*	DOUBLE A PRODUCTS	●	●			●	●	○	●	○	●	●					●		●	●	●	○	
	DOWTY EQUIPMENT LTD.			●			●		●	●	●	●										●	
	DUKES COMPANY			○			○					○						○					
	ELECTROL, INC.	●				●				●	●			●	●	●	●	●					
*	FAIRCHILD ENGINE & AIRPLANE CORP., STRATOS DIVISION			○	○									○	○								
*	FLUID CONTROLS, INC.	●	●			●				●	●	●		●	●	●	●	●	●	●			

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



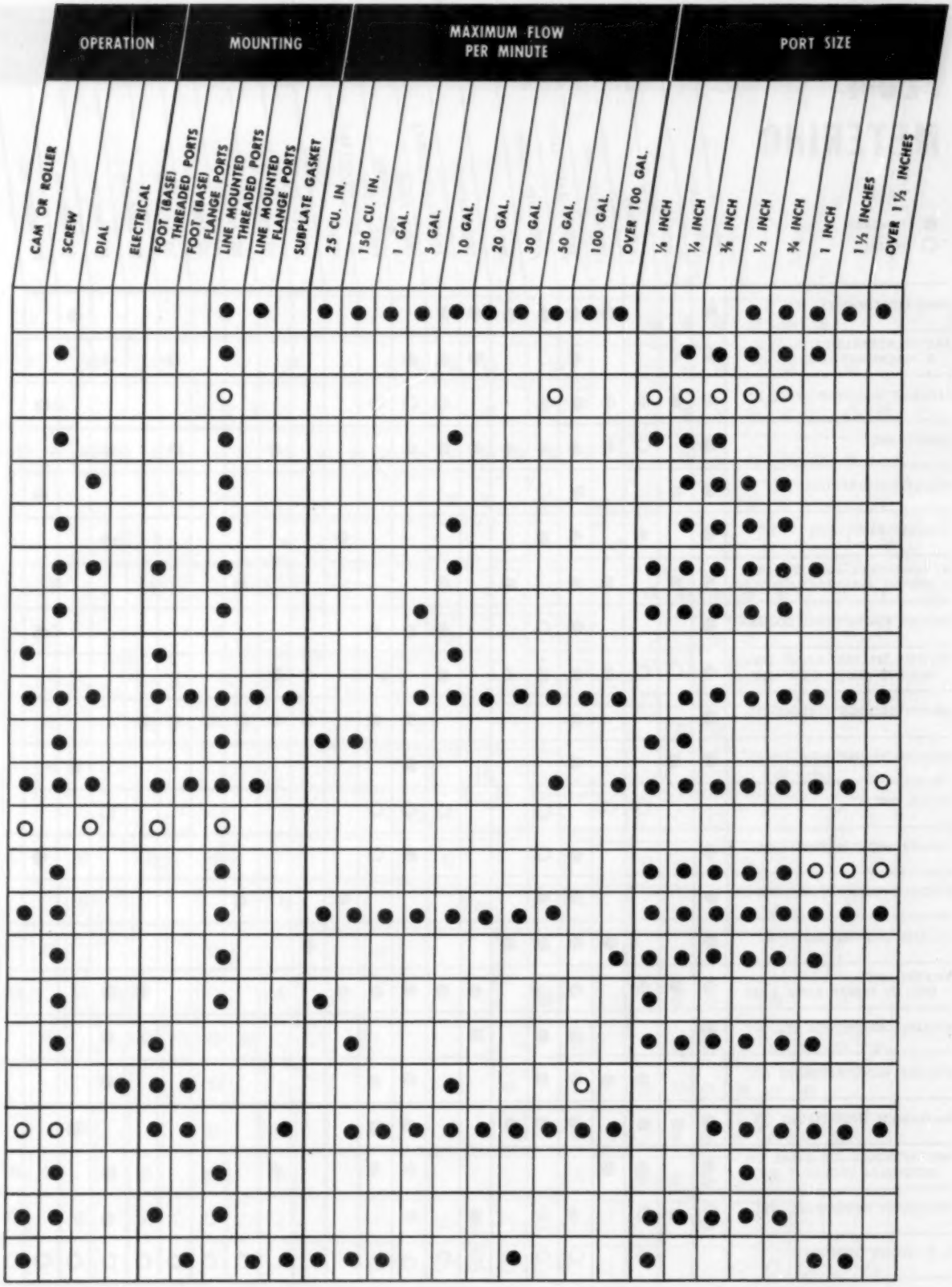
VALVES, FLOW METERING

● STANDARD
○ SPECIAL

		USE				MEDIUM				TYPE					PRESSURE RATINGS								
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	WATER	DECELERATION	ADJUSTABLE ORIFICE	PRESS. COMP. ADJUSTABLE	PRESS. COMP. NON-ADJUSTABLE	SERVO	TO 125 PSI	TO 250 PSI	TO 750 PSI	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	TO 3000 PSI	TO 5000 PSI	TO 10,000 PSI
	FOXBORO COMPANY	●			●					●				●	●	●	●	●	●	●	○	○
*	GALLAND-HENNING MFG. CO. NOPAK DIVISION	●	●		●	●			●		●				●							
*	GAR PRECISION PARTS, INC.	○		○	○	○	○				○	○								○		
	GENERANT ENGINEERING CO.	●	●		●	●	●	●		●											●		
*	HANNA ENGINEERING WORKS	●	●	●	●	●	●	●		●					●								
	HANNIFIN CORPORATION	●			●	●		●		●				●									
	HIGH PRESSURE EQUIPMENT	●	●		●	●	●	●		●													●
*	HOKE, INC.	●			●					●											●		
	HYDRAULIC CONTROLS COMPANY	●	●			●	●		●											●			
*	HYDRAULIC POWER DIVISION HYDRAULIC PRESS MFG. CO.	●	●			●	●		●	●	●									●	●		
*	IMPERIAL BRASS MFG. CO.	●			●	●	●	●		●				●									
*	KEELAVITE ROTARY PUMPS & MOTORS LTD.	●	●			●	○		●	●	●	●								●			
*	WALTER KIDDE & CO., INC.			○	○					○	○	○				○	○	○	○	○	○		
*	I. & I. MANUFACTURING CO.	●	●	○	●	●	●	●		●											●		
*	LOGANSPORT MACHINE CO., INC.	●			●	●	●	●	●	●				●	●	●	●	●	●	●			
*	JAS. P. MARSH CORPORATION	●	●	●	●	●	●	●		●													●
*	MEAD SPECIALTIES CO., INC.	●			●					●				●									
*	MODERNAIR CORPORATION	●			●					●	●				●								
*	MOOG VALVE COMPANY	○	○	●		●	○					○	●								●		
*	NEW YORK AIR BRAKE COMPANY KALAMAZOO DIVISION		○			○	○			○	○	○						●	●				
	C. A. NORGREN COMPANY	●			●	●		●	●						●								
*	NUMATICS, INC.	●			●				●	●					●								
	OIL-DYNE, INC.	●	●	●		●	●		●		●											●	●

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



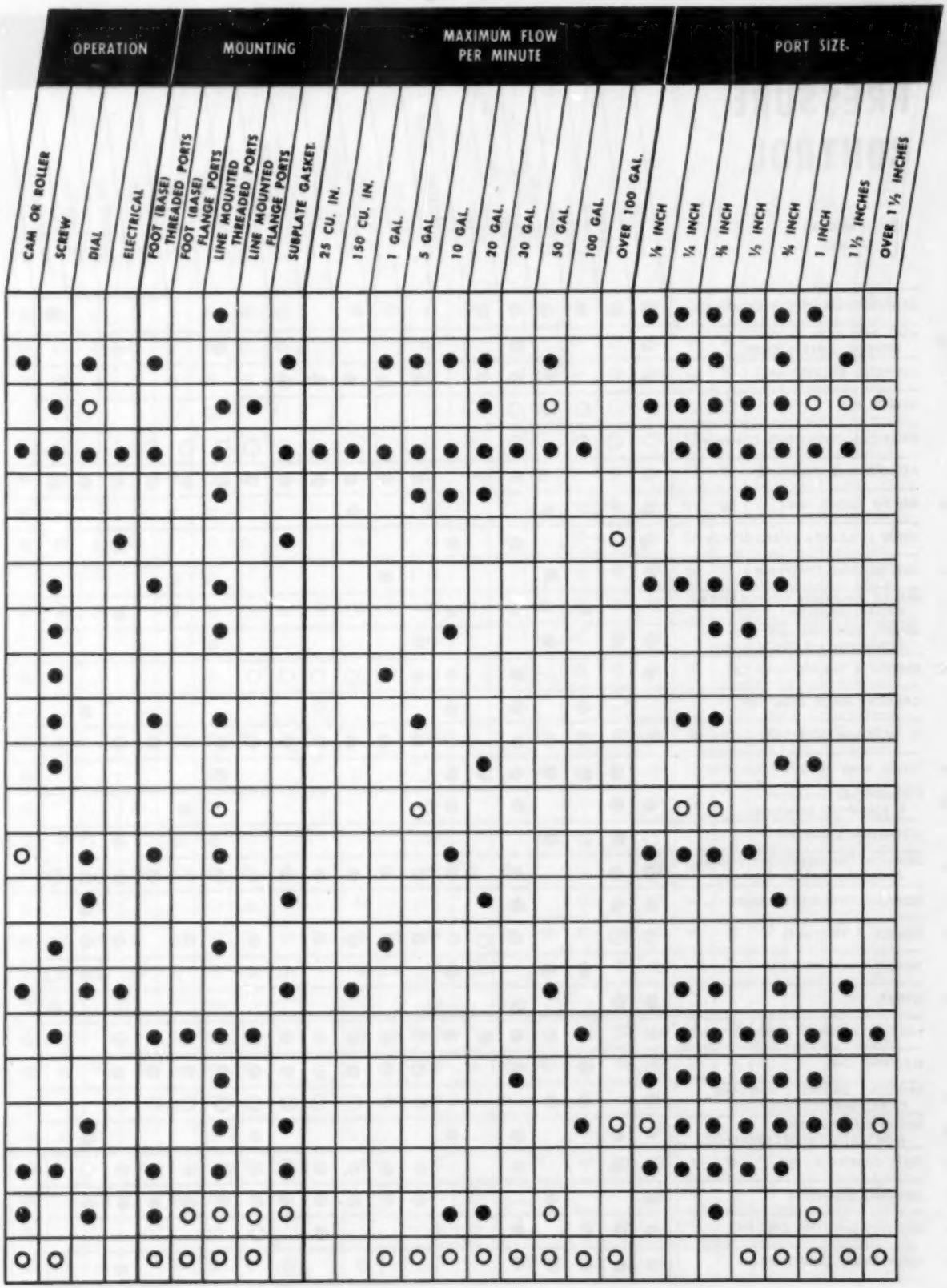
VALVES, FLOW METERING

● STANDARD
○ SPECIAL

	USE				MEDIUM				TYPE					PRESSURE RATINGS								
	INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROL. BASE FLUIDS	FIRE-RESIST. FLUIDS	WATER	DECELERATION	ADJUSTABLE ORIFICE	PRESS. COMP. ADJUSTABLE	PRESS. COMP. NON-ADJUSTABLE	SERVO	TO 125 PSI	TO 250 PSI	TO 750 PSI	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	TO 3000 PSI	TO 5000 PSI	TO 10,000 PSI
* PNEU-TROL DEVICES, INC.	●			●	●	●	●	●	●											●	
* RACINE HYDRAULICS & MACHINERY, INC.	●	●			●	○		●	●	●							●		●		
* REPUBLIC MANUFACTURING CO.	●	●	●	●	●	●			●	○	○										●
* RIVETT, INC.	●		○	●	●	●	●	●	●	●				●			●		●		
RODGERS HYDRAULICS, INC.	●	●			●	○															●
* SANDERS ASSOCIATES	●		●		●	●						●							●		
* A. SCHRADER'S SONS DIVISION SCOVILL MANUFACTURING CO.	●	●		●	●		●		●						●						
* SIMPLEX ENGINEERING COMPANY	●				●	○			●	●	●										●
* SKINNER ELECTRIC VALVE DIV. SKINNER CHUCK COMPANY	●	○	○	●	●	●	●		●					●							
* SMITHS JACKING SYSTEMS LTD.	●				●					●	●		●	●	●	●	●	●			
* SPRAGUE ENGINEERING CORP.	●	●			●					●										●	
TAVCO, INC.			○	○		○			○	○	○								○		
TOWLER BROS. (PATENTS) LTD.	●				●	○				●	○										●
TURCHAN FOLLOWER MACHINE CO.	●				●	●						●			●						
VALCOR ENGINEERING CORP.	●			●	●	●	●						●								
* VICKERS, INC. DIV. OF SPERRY RAND CORP.	●	●	●		●	●		●	●	●	●	●						●	●		
* VICKERS-ARMSTRONGS LTD.	●				●	●		●											●		
VINSON MANUFACTURING CO.			●	●	●	●				●	●								●		
* WATERMAN ENGINEERING CO.	●	●	●		●	●	●			●	●									●	
WESTINGHOUSE AIR BRAKE CO. INDUSTRIAL PRODUCTS DIV.	●		●	●						●	●			●					●		
WISCONSIN HYDRAULICS, INC.	○	●	○		●	●		●		●									●		
R. D. WOOD COMPANY			○		○	○	○	○	○						○	○	○	○	○	○	○

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



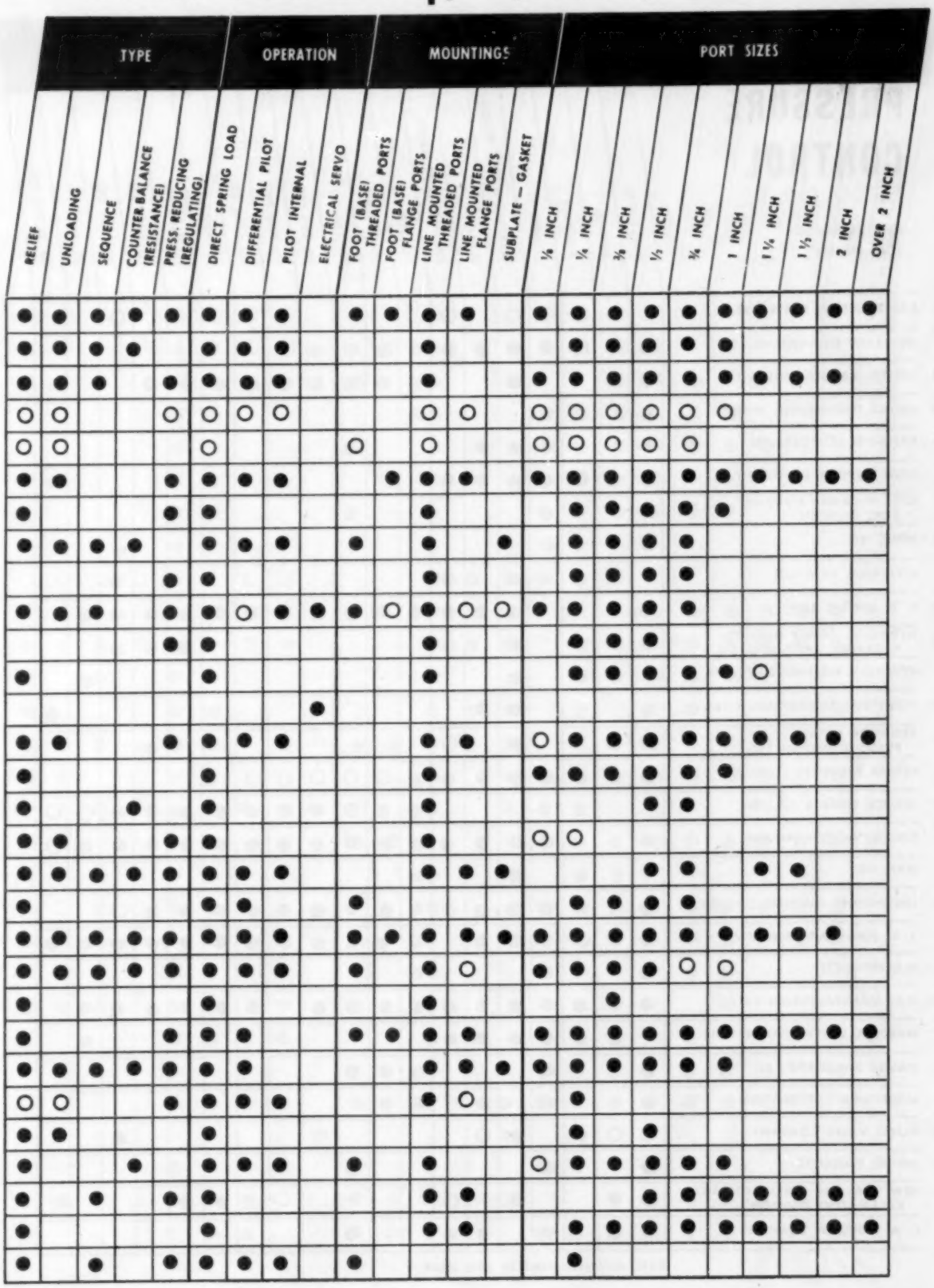
VALVES, PRESSURE CONTROL

● STANDARD
○ SPECIAL

		USE				MEDIUM				PRESSURE RATINGS												
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROLEUM BASE FLUIDS	WATER	FIRE-RESISTANT FLUIDS	TO 125 PSI	TO 200 PSI	TO 250 PSI	TO 500 PSI	TO 750 PSI	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	TO 2500 PSI	TO 3000 PSI	TO 5000 PSI	TO 10,000 PSI
	ACCESSORY PRODUCTS COMPANY	●	●	●	●	●	●													●
*	ADEL PRECISION PRODUCTS DIV. GENERAL METALS CORP.	●				●									●			●		
	AIRMATIC VALVES, INC.	●			●	●	●		●	●	●	●	●							
	ALTAIR, INC.			○	○	○													○	
	AMERICAN INDUSTRIES COMPANY		○	○		○						○	○	○	○	○	○			
	ATLAS VALVE COMPANY	●				●	●		●	●	●	●	●	●	●	●	●	●	●	●
*	ARROW TOOLS, INC.	●			●						●									
	JOHN S. BARNES CORPORATION	●				●		●										●		
*	THE BELLOWS COMPANY	●			●					●										
*	BENDIX AVIATION CORPORATION PACIFIC DIVISION			●		●		●										●		
	BENDIX-WESTINGHOUSE AAB CO. INDUSTRIAL AIR CONTROLS DIV.	●	●		●				●											
*	BROWN & SHARPE MFG. CO.	●				●		●	●	●	○	○	○	○						
	CADILLAC GAGE COMPANY			●		●		●											●	
	A. W. CASH COMPANY	●		○	●	●		○	●	●	●	●	●	●	●	●	●	●		
*	CIRCLE SEAL PRODUCTS CO., INC.		●	●	●	●	●	●							●					
*	COMMERCIAL SHEARING & STAMPING COMPANY	●	●			●		●								●				
	CORNELIUS COMPANY	○	●	●	●													●	○	
*	DENISON ENGINEERING DIVISION AMERICAN BRAKE SHOE CO.	●	●			●		●	●	●	●	●	●	●	●	●	●	●	●	○
	DONNELL HYDRAULIC COMPANY	●	●			●													●	
*	DOUBLE A PRODUCTS	●	○			●	○	●	●	●	●	●		●		●		●	●	●
	DOWTY EQUIPMENT LTD.			●	●			●											●	○
*	DYNEX, INC.	●	●			●														●
	EASTERN AIRCRAFT PRODS. CORP.	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
	ELECTROL, INC.	●		●		●			●	●	●	●	●	●	●	◔	●	●		
*	FAIRCHILD ENGINE & AIRPLANE CORP., STRATOS DIVISION	●		●	●				●	●	○	○	○	○	○	○	○	○		
*	FAWCETT-FINNEY LTD. A METAL INDUSTRIES GROUP CO.	●	●			●		●						●					●	
*	FLUID CONTROLS, INC.	●	●			●			●	●	●	●	●	●	●	●	●	●	○	○
	FOXBORO COMPANY	●			●				●	●	●	●	●	●	●	●	●	●		
*	FULFLO SPECIALTIES CO., INC.	●	●	●		●						●		○						
*	FUTURECRAFT CORPORATION	●	●	●	●	●												●		

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*



VALVES, PRESSURE CONTROL

● STANDARD
○ SPECIAL

		USE				MEDIUM				PRESSURE RATINGS												
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROLEUM BASE FLUIDS	WATER	FIRE-RESISTANT FLUIDS	TO 125 PSI	TO 200 PSI	TO 250 PSI	TO 500 PSI	TO 750 PSI	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	TO 2500 PSI	TO 3000 PSI	TO 5000 PSI	TO 10,000 PSI
*	GAR PRECISION PARTS, INC.	○		○		○		○										○		
	GENERANT ENGINEERING CO.	●	●	○	●	●	●	●	●	●	●	●								
*	GRESEN MANUFACTURING CO.	●	●			●			●	●	●	●	●	●	●	●	●			
*	HANNA ENGINEERING WORKS	●			●				●											
	HANNIFIN CORPORATION	●			●	●	●				●									
	HIGH PRESSURE EQUIPMENT	●	●	○	●	●	●	●												●
	HILLS McCANNA COMPANY ACRC DIVISION	●			●						●									
*	HOKE, INC.	●			●													●		
	HOUDAILLE AVIATION			●		●		●										●		
*	C. B. HUNT & SON	●				●	●	●	●	●	●	●	●	●	●	●	●	●	●	
*	HYDRAULIC POWER DIVISION HYDRAULIC PRESS MFG. CO.	●	●			●		●								●	●	●		
	HYDRAULIC RESEARCH & MFG. CO.			●		●													●	
*	INDUSTRIAL ENGINEERING CORP.	●				●	●													●
*	KEELAVITE ROTARY PUMPS & MOTORS LTD.	●	●			●		○									●			
*	KEPNER PRODUCTS COMPANY	●	●	●	●	●	●	●	●	○	○	○	○	○						
*	WALTER KIDDE & CO., INC.			●	●				●	●	●	●	●	●	●	●	●	●	○	○
	KUNKLE VALVE COMPANY	●			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○
	LEAR, INC.			●		●			●											
*	LOGANSPORT MACHINE CO., INC.	●			●	●	●	●	●	●	●	●	●	●	●	●	●	○		
	J. E. LONERGAN COMPANY	●	●	○	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
	M-B PRODUCTS	●			●				●											
*	M.C. MANUFACTURING CO.	●		●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	
	MAROTTA VALVE CORPORATION		●	●	●	●	●	●											●	
	MASTER PNEUMATIC, INC.	●			●				●	●	●									
*	MODERNAIR CORPORATION	●			●		●		●	●										
*	MOOG VALVE COMPANY	○	○	●		●	○											●		
	MOORE PRODUCTS	●			●						●									
*	NEW YORK AIR BRAKE COMPANY KALAMAZOO DIVISION	●	●			●		○							●	●				
	C. A. NORGREN COMPANY	●	●		●		●	●			●									

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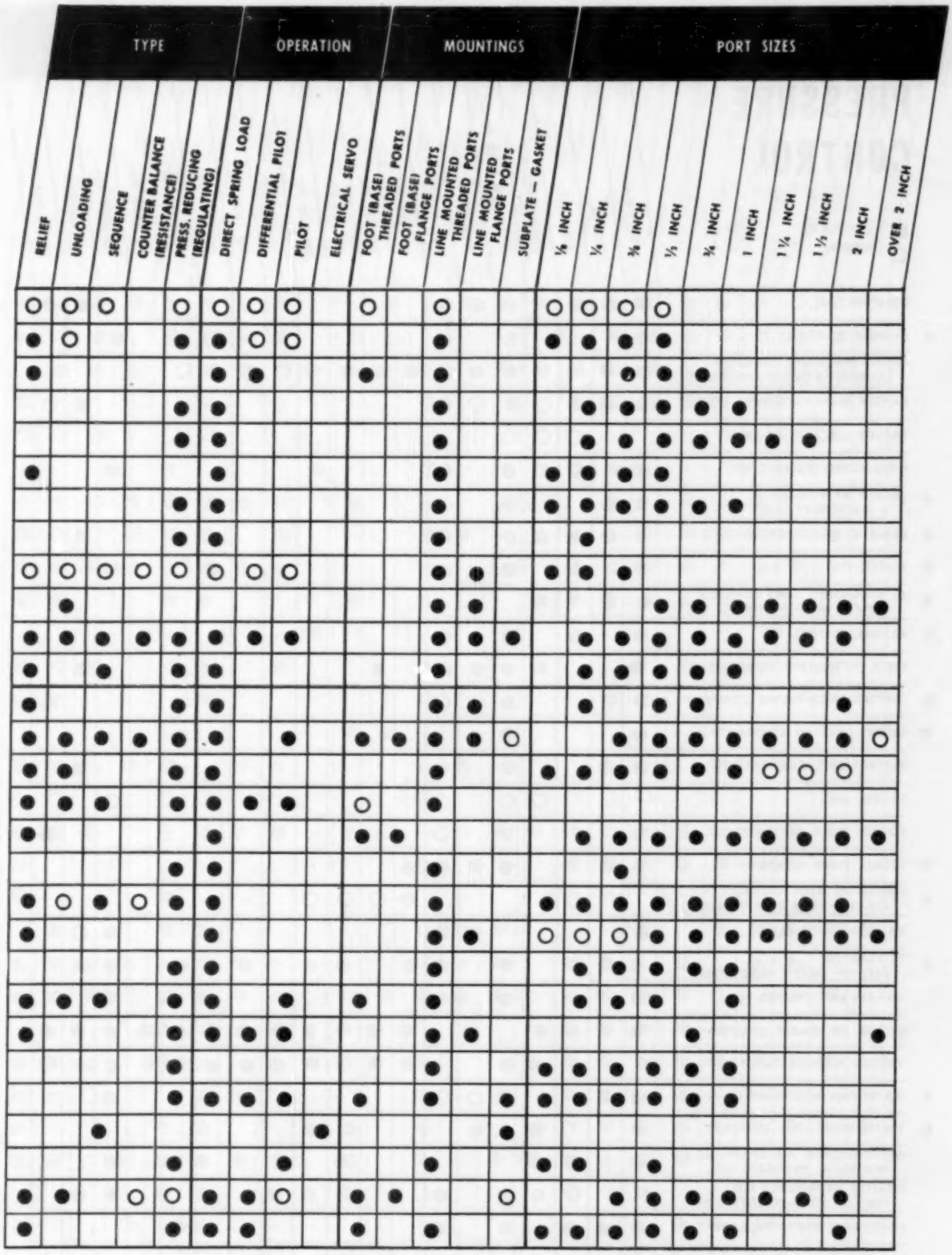
TYPE
OPERATION
MOUNTINGS
PORT SIZES
RELIEF
UNLOADING
SEQUENCE
COUNTER BALANCE (RESISTANCE)
PRESS. REDUCING (REGULATING)
DIRECT SPRING LOAD
DIFFERENTIAL PILOT
PILOT
ELECTRICAL SERVO
FOOT (BASE) THREADED PORTS
FOOT (BASE) FLANGE PORTS
LINE MOUNTED THREADED PORTS
LINE MOUNTED FLANGE PORTS
SUBPLATE – GASKET
⅛ INCH
¼ INCH
⅜ INCH
½ INCH
¾ INCH
1 INCH
1¼ INCH
1½ INCH
2 INCH
OVER 2 INCH

VALVES, PRESSURE CONTROL

● STANDARD
○ SPECIAL

		USE				MEDIUM			PRESSURE RATINGS												
		INDUSTRIAL	MOBILE	AIRCRAFT	COMPRESSED AIR	PETROLEUM BASE FLUIDS	WATER	FIRE-RESISTANT FLUIDS	TO 125 PSI	TO 200 PSI	TO 250 PSI	TO 500 PSI	TO 750 PSI	TO 1000 PSI	TO 1500 PSI	TO 2000 PSI	TO 2500 PSI	TO 3000 PSI	TO 5000 PSI	TO 10,000 PSI
	OIL-DYNE, INC.	●	●	●		●	●	●											●	●
*	OILGEAR COMPANY	●				●		●							●			●		
	ORTHO-PNEUMATIC DIVISION LAURENCE'S ORTHO APPLIANCES	●	●		●	●	●	○	●	●	●	●	○	○	○	○				
	PANTEX MANUFACTURING CORP.	●	●	●	○	●	○	●											●	○
	PARKER AIRCRAFT COMPANY			○	○	○														
	PNEU-HYDRO VALVE CORP.	●		●	●	●		●										●		
*	RACINE HYDRAULICS & MACHINERY, INC.	●	●			●		○							●					
*	REPUBLIC MANUFACTURING CO.	●	●	●	●	●		●											●	
*	RIVETT, INC.	●				●		●							●			●		
*	A. SCHRADER'S SONS DIVISION SCOVILL MANUFACTURING CO.	●	●		●						●									
*	SANDERS ASSOCIATES	●		●		●		●												
	SEELY INSTRUMENT COMPANY	●			●	●	●	●		●									●	
*	SIMPLEX ENGINEERING COMPANY	●				●		○												●
*	SMITHS JACKING SYSTEM LTD.	●				●										●				
	SUPERDRAULIC CORPORATION	●	●			●		●											●	
	TAVCO, INC.				○	○		○										○		
	TOWLER BROS. (PATENTS) LTD.	●				●		○												●
*	TUTHILL PUMP COMPANY	●	●			●	●	●	●											
*	UNITED METALLIC O-RING CORP. DIV. UNITED AIRCRAFT PRODS.			○					●	○	○	○								
	VALV-TROL COMPANY	●					●	●										●	○	
*	VICKERS, INC. DIV. OF SPERRY RAND CORP.	●	●	●		●		●	●		●	●		●		●		●	●	
	VICKERS-ARMSTRONGS LTD.	●				●		●										●		
	VICTOR EQUIPMENT COMPANY	●	●	●	●				●	●	●	●	●	●	●	●	●	●	●	●
	VINSON MANUFACTURING CO.			●	●	●			●	●	●	●	●	●	●	●	●	●	●	○
*	WATERMAN ENGINEERING CO.	●	●			●	○	○										●		
*	WATTS REGULATOR COMPANY	●			●	●	●					●								
	WESTINGHOUSE AIR BRAKE CO. INDUSTRIAL PRODUCTS DIV.	●		●	●						●							●		
	WESTON HYDRAULICS LTD. DIV. OF BORG-WARNER CORP.			○	●	●		●										●	●	
	WISCONSIN HYDRAULICS, INC.	●	●	●		●		●								●				
	R. D. WOOD COMPANY	○																	○	

*SEE ADVERTISEMENT IN THIS ISSUE

APPLIED HYDRAULICS | *fluid power component selection chart*

TYPE						OPERATION				MOUNTINGS					PORT SIZES									
RELIEF	UNLOADING	SEQUENCE	COUNTER BALANCE (RESISTANCE)	PRESS. REDUCING (REGULATING)	DIRECT SPRING LOAD	DIFFERENTIAL PILOT	PILOT	ELECTRICAL SERVO	FOOT (BASE) THREADED PORTS	FOOT (BASE) FLANGE PORTS	LINE MOUNTED THREADED PORTS	LINE MOUNTED FLANGE PORTS	SUBPLATE – GASKET	⅛ INCH	¼ INCH	⅜ INCH	½ INCH	¾ INCH	1 INCH	1¼ INCH	1½ INCH	2 INCH	OVER 2 INCH
●	●	●	●	●	●	●	●			●		●	●	●	●	●	●	●	●	●	○	○	○	
●	●	●		●	●	●	●		●	●			●			●	●	●	●	●	●	●	●	●
	●	●	●		●	●	●		●		●		●	●	●	●	●	●	●	○	○	○		
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FLUIDS, HYDRAULIC, PETROLEUM BASE

● STANDARD
○ SPECIAL

		USE			VISCOSITY 100F. ATMOS. PRESS.			VISCOSITY INDEX					ADDITIVES					
		INDUSTRIAL	MOBILE	AIRCRAFT	150 TO 300 SSU	300 TO 450 SSU	300 TO 1000 SSU	UNDER 50	50 TO 80	80 TO 90	90 TO 100	OVER 100	RUST INHIBITOR	OXIDATION INHIBITOR	VISCOSITY INDEX IMPROVER	ANTI-FOAM	FILM STRENGTH IMPROVER	POUR POINT DEPRESSANT
*	THE BELLOWS COMPANY	●			●					●			●	●		●		
	GULF OIL CORPORATION	●			●	●	●	●	●	●	●	●	●	●		●	●	
*	E. F. HOUGHTON & COMPANY	●	●		●	●	●				●	○	●	●	○	○	●	●
	SHELL OIL COMPANY	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	SINCLAIR REFINING COMPANY	●	●		●	●	●			●	●	●	●	●	●	●	●	●
	STANDARD OIL CO. (INDIANA)	●	●		●	●	●			●	●	●	●	●		●		●
*	SUN OIL COMPANY	●	●		●	●	●	●	●	●		○	●	●	●	●	●	●
*	THE TEXAS COMPANY	●	●		●	●	●				●		●	●		●		

*SEE ADVERTISEMENT IN THIS ISSUE

FLUIDS, HYDRAULIC, SYNTHETIC

● STANDARD
○ SPECIAL

		USE			TYPES							VISCOSITY 100F. ATMOS. PRESS.				VISCOSITY INDEX			TEMPERATURE RANGE			
		INDUSTRIAL	AIRCRAFT	WATERGLYCOL	PHOSPHATE ESTERS	CHLORINATED HYDRO CARBONS	SILICATE ESTERS	DIESTERS	SILICONES	WATER EMULSION	TO 60-110 SSU/22CS	150 TO 190 SSU/22-23 CS	190 TO 240 SSU/41-52 CS	240 TO 300 SSU 52-63CS & UP	TO 40	40 TO 120	120 TO 150 AND OVER	-65 TO 160 F. TYPE I	-65 TO 275 F. TYPE II	-65 TO 400 F. TYPE III	0 TO 550 F. TYPE IV	50 TO 180 F.
*	THE BELLOWS COMPANY	●			●							●				●		●				
*	CARBIDE & CARBON CHEMICALS COMPANY	●		●								●		●			●					●
*	CELANESE CORP. OF AMERICA	●	●		●						●	●	●	●	●		○		●			
	R. M. HOLLINGSHEAD CORP.		●	●			○	○			●	●	●					●		●		
*	E. F. HOUGHTON & COMPANY	●		●	●								●	●	●		●					
*	MONSANTO CHEMICAL COMPANY	●	●		●	●	●				●	●	●	●	●	●	●		●	●	●	
	ORONITE CHEMICAL COMPANY		○				○					○		○						○	○	
	SHELL OIL COMPANY	●								●				●			●					●
	UNION CARBIDE & CARBON CORP. SILICONES DIVISION	●	●						●			●	●	●			●		●	●		

*SEE ADVERTISEMENT IN THIS ISSUE

25% Larger capacity valve gives faster action to backhoe

The main valve on all Henry Hydraulic Backhoes is the new Commercial "Performance Rated" TB05 series.

Chosen because it has a greatly reduced *back pressure* this valve is teamed up with a pump having greater discharge than was in former use. Much faster action of the backhoe results and this is most important to a contractor who must keep working on schedule.

Three point suspension positions new tandem valve. Operator easily controls directional flow of fluid power to operate backhoe attachment.

Because of the parallel circuit built into these valves, simultaneous operation of two or more cylinders makes digging and load discharge one smooth continuous operation.

Consisting of an inlet section, five working sections and the outlet section, this tandem valve controls the operation of the cylinders which actuate the boom, swing, lift, crowd and bucket. The built-in combination safety relief-pressure control gives safety protection to the entire hydraulic circuit and prevents overloading the structural members of the equipment. The design of these new valves makes it a simple matter to incorporate special feature valves to give plus values to the equipment.

"Henry" mounts directly below this valve a swing cushion valve which smooths out the action of the boom as it comes to the end of its swing. This takes the shakes out of the equipment and reduces its wear and tear, thus lengthening service life of the equipment.

Service problems and breakdowns are minimized because the sectional feature of the tandem valve permits servicing in the field of any one section and does not require replacement of the entire valve.

Henry Manufacturing Company says, "We feel that Commercial valves have contributed to the dependability and performance which has accounted for many sales of our equipment when demonstrated against competitive machines."

You, too, will find that these new "Performance Rated" valves will improve your equipment's salability. Write to Dept. A-1, The Commercial Shearing and Stamping Company, Youngstown, Ohio, for the Performance Data which will show you what goes on inside these valves.

COMMERCIAL
shearing and stamping

MEMO – 1957

There's no substitute for proven superiority in "O" rings—

This year, as always, Parco leads the field in engineering, production and required delivery in "O" rings.

Consistent quality through years of service has earned Plastic and Rubber Products the highest reputation in the automotive field. Time and again only Parco "O" rings have been selected because of their toughness, ability to withstand abuse, as well as for workmanship and finish. All dash numbers of 6227, 6230, 6290, 29513 and 28784 series for commercial applications or military installations to specifications MIL-P-5516, MIL-G-5510, MIL-P-5315 and MIL-P-18017 are available from stock. Special compounds are available on order.

BRAKES

SEATS

STEERING

TRANSMISSION

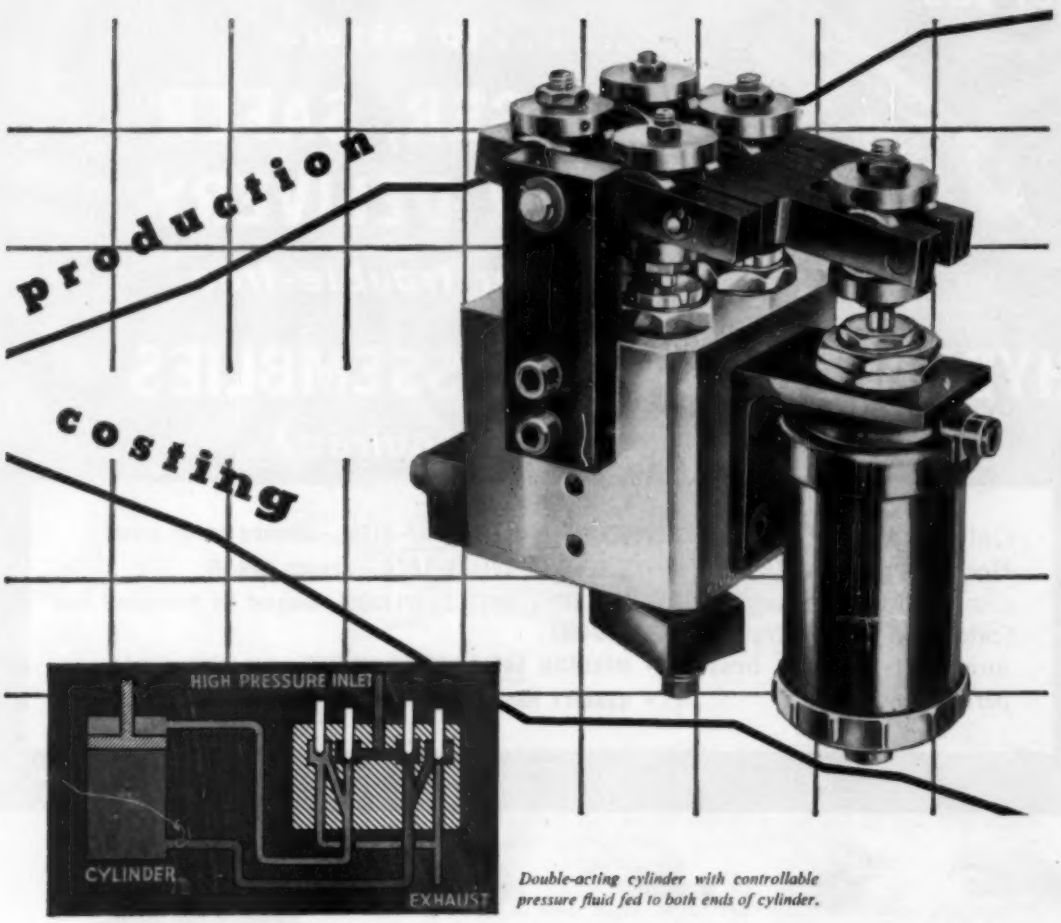
Send for your personal copy of Plastic and Rubber Products Engineering Handbook #525.

Parco

PLASTIC AND RUBBER PRODUCTS CO.

2100 Hyde Park Boulevard, Los Angeles 47, California
P. O. Box 645, Edgewater Br., Cleveland, Ohio
2130 W. Irving Park Road, Chicago 18, Illinois
1900 E. Jefferson St., Detroit 7, Michigan
1420 Alice Street, Oakland 12, Calif.

AUTOMATION at low cost



Double-acting cylinder with controllable pressure fluid fed to both ends of cylinder.

Operating in conjunction with timing instruments, Ellison Hydraulic Valves provide Automation with little capital outlay—enabling several hydraulically operated machines to be controlled automatically by a single operator. Further, arrangements can be made for automatic control of machine safety guards to comply with Factory Act regulations. Ellison Valves mark a real step forward in hydraulic practice.

They embody new features to prevent scoring of seats and stems and to ensure trouble-free service with little maintenance.

Send for full details and ask to see a Valve.

Made by

GEORGE ELLISON
LIMITED

PERRY BARR BIRMINGHAM 22B.
ENGLAND

.806

ENGINEERS—

It's a CHAMP designed for you

. . . to assure

LONGER, SAFER POWER DELIVERY

wherever trouble-free

HYDRAULIC HOSE ASSEMBLIES

are required!

Only CHAMP Hydraulic Hose Assemblies offer this combination of engineered features so your hydraulic unit will give its best performance:

- **SERRATED SLEEVE AND STEM—maximum holding power!**
- **SLEEVE TO COLLAR LOCK—prevents blow-off!**
- **ALL STEEL HOSE COUPLINGS—designed for dimensional hose variations!**
- **MAXIMUM SAFE INNER DIAMETER—high volume flow!**
- **QUALITY HOSE—longest life with hydraulic fluids!**

WRITE FOR CATALOG 8001 for details on CHAMP Hydraulic Hose Assemblies to meet specific performance standards . . . in a range of sizes and assembly types for various working pressures . . . for all hydraulic power driven equipment.

Champ

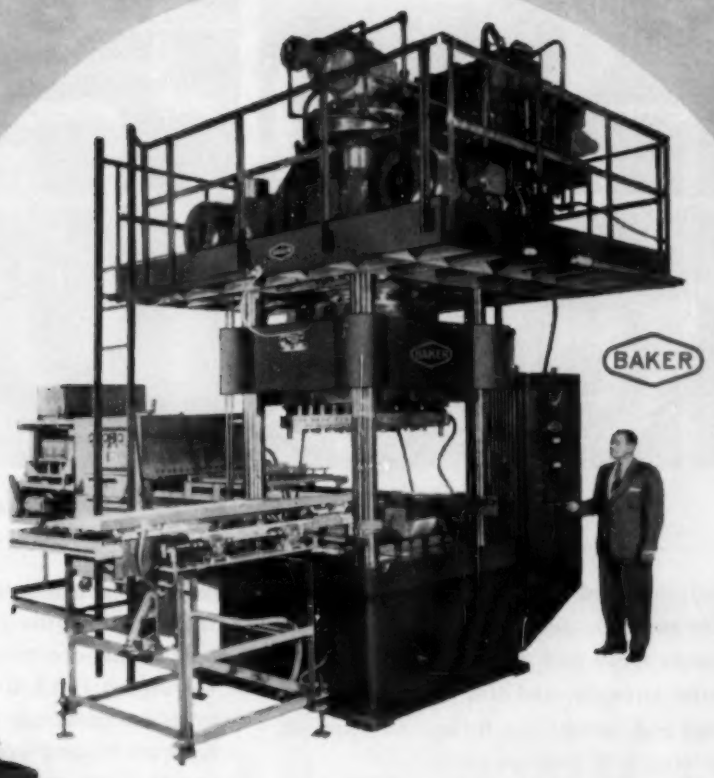
DIVISION OF **HOSE ACCESSORIES COMPANY**

LEHIGH AVE. AND 17TH STREET • PHILADELPHIA 32, PA.

VERSATILE

Double A VALVES SPECIFIED

"to simplify hydraulic circuits . . . reduce costs"



This 450 ton compression press made by Baker Brothers Inc., Toledo, is the first ever built with provision for complete automation in the production of phenolic plastic parts. A battery of four — equipped with Double A Valves — currently turns out all the pump impellers for one of the "big three" automobile manufacturers.

Typical of valves on Baker Presses is this 1½" solenoid-controlled, pilot-operated, 4-way valve. It is pressure-centered — for faster shifting, and it's completely dependable — no spring failures!

Here's why Baker Brothers specified Double A Valves: You can modify one of Double A's many standard valves and come up with a valve that will replace two or, in the Baker presses, for example, four ordinary valves.

As a Baker Hydraulics Engineer put it, "Double A Valves are so versatile we were able to simplify our hydraulic circuits with a consequent saving in cost and space."

Double A's complete line of valves — the ease with which they lend themselves to modification — and the willingness of Double A engineers to work with you on modifications for specific jobs, can mean actual dollar savings to you.

For the full story on All Double A Valves, write for Catalog No. 551.

●

REPRESENTATIVES IN PRINCIPAL CITIES IN THE U.S. AND CANADA

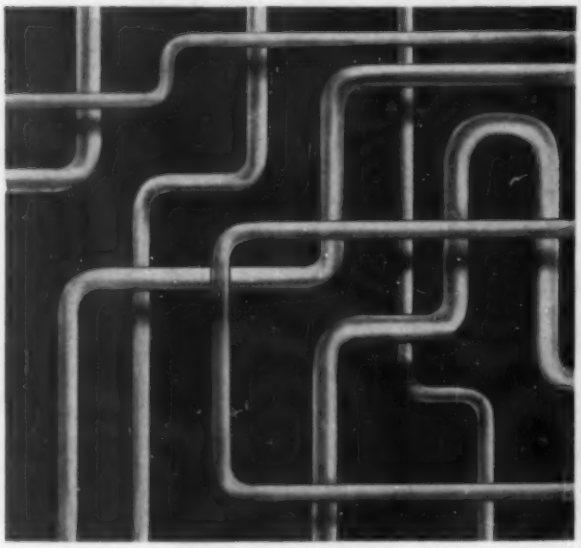
●

Double A

PRODUCTS CO.

Manchester, Michigan

Eliminate Costly Hydraulic Failures with



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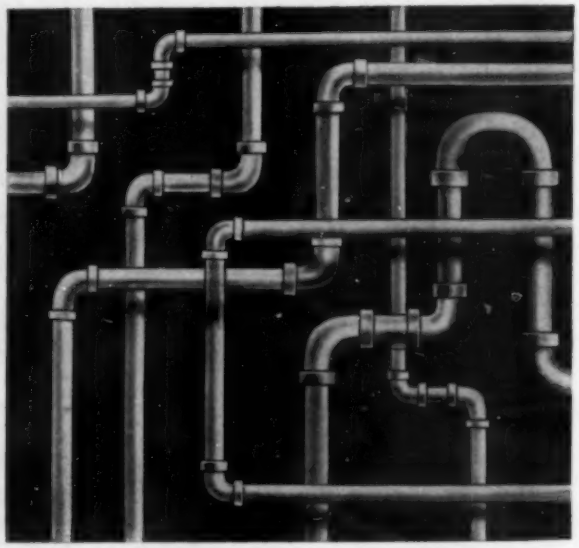


NOT THIS

Today's hydraulic and design engineers know that tubing is the modern, efficient method of handling fluids. It saves space and weight. It offers tighter joints, greater strength, and less pressure drop. It is easily bent and flared. Less fittings are required. Installation costs and time are lower.

Superior specializes in producing seamless low-carbon steel hydraulic tubing that is closer on critical features than the SAE specifications. The table below lists recommended maximum working pressures (psi) for hydraulic tubing. Sizes for which pressure limits are printed inside block at lower right are beyond Superior's production limits. These larger sizes are also available, however, from Superior distributor warehouse stocks.

Maximum Working Pressures (psi) Recommended for Hydraulic Tubing

WALL OD	.025"	.028"	.032"	.035"	.042"	.049"	.058"	.065"	.072"	.083"	.095"	.109"	.125"
1/8"	6000	6700	7680	8430	9920	11750	x	x	x	x	x	x	x
3/16"	4000	4470	5100	5610	6750	7850	x	x	x	x	x	x	x
1/4"	2980	3350	3830	4200	5040	5890	7000	7850	x	x	x	x	x
5/16"	2410	2690	3080	3370	4040	4710	5610	6290	6950	8010	x	x	x
3/8"	1990	2240	2560	2800	3360	3920	4660	5240	5790	6660	7640	8720	9990
13/32"	1845	2070	2360	2585	3100	3620	4285	4800	5320	6130	7015	8050	9235
7/16"	1715	1920	2190	2400	2880	3360	4000	4500	4960	5720	6550	7490	8580
1/2"	1490	1675	1920	2100	2520	2940	3500	3925	4340	5000	5720	6540	7500
9/16"	1330	1490	1705	1870	2240	2620	3110	3490	3860	4450	5090	5810	6660
5/8"	1200	1340	1535	1680	2020	2350	2800	3140	3470	4000	4580	5230	6000
11/16"	1090	1220	1395	1530	1830	2135	2530	2835	3140	3620	4145	4755	5455
3/4"	1000	1120	1280	1400	1640	1960	2320	2600	2880	3320	3800	4360	5000
7/8"	860	960	1090	1200	1440	1680	1985	2225	2465	2845	3255	3740	4285
1"	750	840	960	1050	1260	1470	1740	1950	2160	2490	2850	3270	3750
1 1/8"	665	747	854	935	1120	1310	1545	1735	1920	2215	2535	2910	3330

Note: The values above are based on an allowable fibre stress of 15,000 psi. For approximate bursting pressures, multiply these values by a factor of 3.3. The formula used for calculating the above pressures is Barlow's: $P = \frac{2St}{OD}$ where S = fibre stress in psi, t = wall thickness in inches, OD = Outside diameter in inches

Premium Superior SAE Hydraulic Steel Tubing

5 IMPORTANT REASONS WHY SUPERIOR SAE HYDRAULIC TUBING IS YOUR BEST CHOICE

1. *It contains 0.12% maximum safe carbon content for high ductility—permits easy hand bending and flaring*
2. *It is manufactured from special non-aging steel that prevents loss of ductility and impact resistance during storage and/or use*
3. *It is hydrostatically tested at maximum working pressures*
4. *Its clean, smooth inside surface minimizes pressure drop due to back pressure and internal friction*
5. *Installed with proper tube fittings, it is dependable and leakproof*

RAW MATERIAL undergoing boroscopic examination, part of Superior's quality control program.

TUBING MUST FLARE without difficulty and without forming minute surface notches or breaks.

EVERY SINGLE LENGTH of Superior (SAE) Hydraulic Tubing is 100% hydrostatic tested.

But Superior hydraulic tubing offers you many more big advantages. It is produced under rigid quality controls that begin with general inspection and boroscopic examination of raw stock. Tubing is mandrel drawn to hold the ID to commercial tolerances or better. Bright annealing and degreasing produce clean, scale-free tubing. The ends, outside and in, are deburred. Each order is inspected for flareability by a careful sampling method and 100% hydrostatically tested. It is then oil-dipped for rust prevention. At the customer's request, tubing can also be capped or corked to keep ID surfaces clean. It is then carefully wrapped in waterproof paper and boxed for shipment. Tubing is furnished in dead soft-annealed temper for ease in bending and is available in cut, multiple or random lengths up to 30 feet or longer in coiled form.

Below are just a few of the many applications for Superior low carbon steel SAE hydraulic tubing. They may suggest other practical uses to you.

Hydraulic lines on machine tools, extension presses, welding machines and control panels • Oil and fuel lines on aircraft engines • Agricultural equipment control lines • Refrigerator generator pump lines • Parts of machinery for glass forming and bottle blowing • Diesel locomotive lubrication lines • Heating coils for oil and asphalt kettles • Vaporizing coils for oil burners and torches • Service station lubrication equipment • Materials handling equipment • Construction equipment

If you have hydraulic tubing problems, let Superior's tubemanship and years of industry-wide experience help solve them. Write Superior Tube Company, 2030 Germantown Ave., Norristown, Pa., for Bulletin No. 39, giving additional technical data on hydraulic tubing.

SUPERIOR LOW-CARBON STEEL SAE HYDRAULIC TUBING IS AVAILABLE IN MANY SIZES IN SUPERIOR DISTRIBUTOR WAREHOUSES FROM COAST TO COAST

Superior Tube

The big name in small tubing

NORRISTOWN, PA.

All analyses available in .010 in. to ⅝ in. OD—certain analyses in light walls up to 2½ in. OD

West Coast: Pacific Tube Company, 5710 Smithway St., Los Angeles 22, Calif.

SMITHS
HYDRAULICS

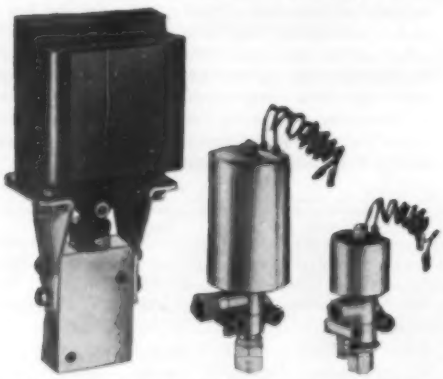
POWER UNITS

High speed radial plunger pumps, ¼ to 5 g.p.m. maximum working pressure 2,000 p.s.i. with facilities for splitting the flows. Can be supplied mounted on A.C. or D.C. motors.

3-SPEED HAND PUMPS

Alternative Deliveries: .65 cu. ins. to 1.88 cu. ins.
Pressure: 1750 p.s.i. Max: Working.
Fitted with control and non-return valve. Relief valve optional.

SOLENOID VALVES



A.C. and D.C. coils continuous and intermittent, working with various 2, 3 and 4 way valves—either spool or poppet type.

THE UNITS ILLUSTRATED COVER ONLY PART OF OUR RANGE WHICH INCLUDES JACKS, HAND OPERATED CONTROLS, ETC.

We welcome your enquiries for this equipment and our experience in various hydraulic fields is available to you.

A diagrammatic sketch of your application is very helpful to our engineers. Please indicate the number of operations per 24 hours, approximate temperature of working conditions, indoor or outdoor, together with as much general information as possible. Also please state the number or potential number of sets required.
On our part we are well equipped to develop new projects in close co-operation with your engineers.

SMITHS

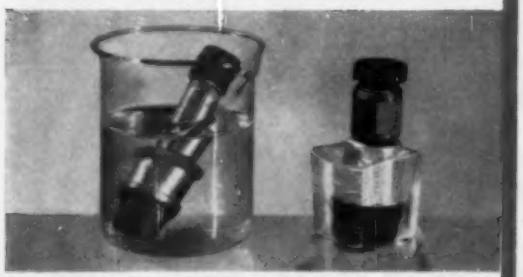
JACKING SYSTEMS LIMITED

A Company of the Motor Accessory Division of S. Smith & Sons (England) Ltd.

JACKALL WORKS, EDGWARE RD., LONDON, N.W.2. Tel: GLAdstone 6671-4

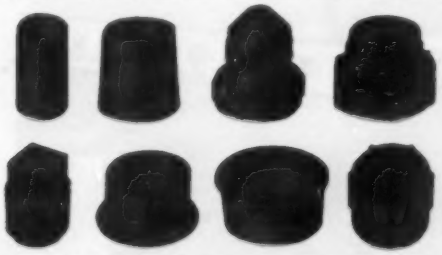
AP 261/38

SEE HOW EASY THEY SLIP ON, AND OFF!
Tapered (non-threaded) CaPlugs can be used as caps or plugs, inside or outside of threaded or plain fittings. Threaded styles are knurled to spin on or off with ease. Costing less to buy, they cost less to apply.



SEE HOW THEY WITHSTAND ACIDS, SOLVENTS, HEAT AND COLD . . . and keep out dust and moisture, too. Dunk a CaPlugged product in any solution. Subject it to actual process conditions and temperatures. Made of tough, flexible Polyethylene, CaPlugs are impervious to most common chemical reagents, acids and solvents . . . retain form stability under stress at temperatures from -94°F. up to 175°F.

SEE HOW TOUGH THEY ARE. For proof, drop a product on its CaPlug . . . tap it with a mallet . . . or make a trial shipment of parts with CaPlugs applied. You'll find that these versatile closures provide "kid-glove" protection and will not collapse, chip, break or shred under the most severe of conditions.



SEE HOW EASY IT IS TO GET CaPlugs THAT FIT. By mailing the coupon, you'll receive a free sample of each of the ten different styles which are available in a combined total of over 300 stock sizes. There's a CaPlug that's *right* for practically any closure need. You name it! "Off-the-shelf" deliveries from a 30,000,000 inventory can be made to answer immediate requirements promptly.

see how CaPlugs can protect your products

(IN PROCESS, TRANSIT AND STORAGE)

b[illegible]est[illegible] a free sample assortment like this

YOU'RE INVITED TO TEST CaPlugs in any way you choose. The coupon below will bring a random assortment to your desk . . . plus illustrated literature, complete details and prices. Reasonable quantities of additional samples in specific sizes for testing are also yours for the asking (details in literature).

MAIL THIS COUPON FOR FREE BOX OF CAPLUGS, DETAILS AND PRICES

CAPLUGS DIVISION, PROTECTIVE CLOSURES CO., INC.
2203 Elmwood Ave., Buffalo 23, N. Y.

RUSH a free assortment of CaPlugs, literature and prices to us, without obligation.

NAME _____ TITLE _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

How can you afford ordinary gear type couplings when AJAX NEW 3-D Degree DIHEDRALS HANDLE 3 DEGREE MISALIGNMENT at the same low price?

With ability to handle angular and offset misalignment...with minimum backlash... with perfected lubricant sealing...with long life,—Ajax Dihedral Couplings have made ordinary couplings obsolete.

And now AJAX adds this new 3-D Self-aligning Dihedral Coupling at prices competitive with ordinary gear type couplings.

Features of the new Ajax 3-D Dihedral Coupling include:

3 degree misalignment capacity.

Load is distributed at center of teeth at the point of greatest strength.

More tooth strength is provided under misalignment than is possible with any other tooth shape.

Exclusive Ajax Dihedral tooth design has less clearance than conventional gear type couplings.

No end-of-tooth wear under misalignment. Johns-Manville "Clipper" seals keep lubricant in and foreign matter out.

Compact overall size.

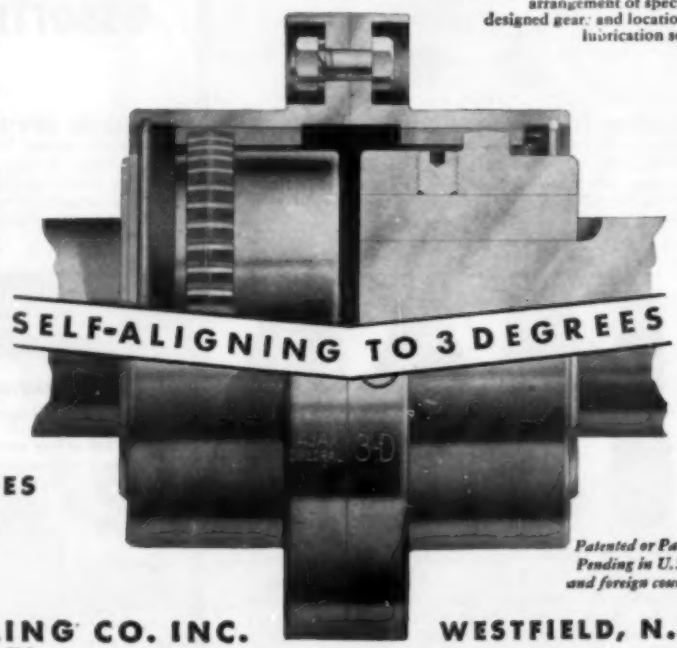
Designed for NEMA motors with standard keys.

Low prices competitive with ordinary gear type couplings.

AVAILABLE IN 5 SIZES

Write for new Catalog No. 60

Cut-away view of Ajax 3-D Dihedral Self-aligning Coupling showing arrangement of specially designed gears and location of lubrication seals.



Patented or Patents Pending in U.S.A. and foreign countries.

AJAX FLEXIBLE COUPLING CO. INC. WESTFIELD, N. Y.

Representatives in Principal Cities

The World's Most Complete Line of Flexible Couplings

Specify These Aeroquip Hose Lines For Fluid Line Systems Up To 3000 psi.

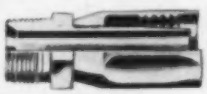
AEROQUIP 1503 AND 1502 HOSE is constructed with a synthetic rubber inner tube, a reinforcing layer of single wire braid, and an oil and mildew resistant cotton braid cover. Tube sizes from ¼" through 2½".

AEROQUIP 2651 AND 2652 HOSE features the same tough construction as 1503 Hose, but has an oil, mildew and abrasion resistant rubber cover. Tube sizes from ¼" through 3".

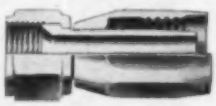
Dash size (in 1/16 in.)	4	5	6	8	10	12	16	20	24	32	40	48
O. D. Tube size	¼	5/16	3/8	½	5/8	¾	1	1¼	1½	2	2½	3
Hose I. D.	3/16	¼	5/16	13/32	½	5/8	¾	1⅛	1⅜	1 13/16	2⅜	3
Hose O. D.	33/64	37/64	43/64	49/64	59/64	1 5/64	1 13/64	1½	1¾	2 7/32	2⅞	3 19/32
Working psi.	3000	3000	2000	2000	1750	1500	800	600	500	350	250	200
Min. burst psi.	12000	10000	9000	8000	7000	6000	3200	2500	2000	1400	1000	800
1503-1502 Hose Min. bend radii	1 15/16	2 5/16	2⅝	4⅛	5½	6½	7⅜	9	10½	13¼		
2651-2652 Hose Min. bend radii	3	3⅜	4	4⅝	5½	6½	7⅜	9	10½	13¼	24	33

ALL DIMENSIONS IN INCHES

END FITTINGS AVAILABLE

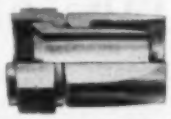


Male Pipe—¼" to 3"



J. I. C. Swivel—¼" to 3"

S. A. E. Swivel—¼" to ¾"



P. T. T. Swivel—1" to 2"

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Aeroquip 1503, 1502 and 2651, 2652 Single Wire Braid Hose and Reusable Fittings offer many advantages in the design of medium pressure fluid line systems. Recommended for hydraulic, lube and fuel oil, water and air lines, Aeroquip Flexible Hose Lines are superior in installations subject to vibration, stress or flexing. Because of their flexibility, Aeroquip Hose Lines are easy to install in confined spaces, with fewer elbows or adapters than are required with rigid piping or tubing.

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All Aeroquip Fittings are detachable and reusable. Fittings and hose can be assembled and disassembled quickly. With a supply of bulk hose and reusable fittings, hose assemblies can be made quickly and in quantity in the manufacturer's plant—without need for expensive swaging machines. Another advantage is that hose assemblies on engineering mock-ups can be modified and installed in seconds, using standard bench tools.

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Aeroquip quality standards are the highest in the industry. From raw materials to workmanship to final inspection, precise, accurate quality control is maintained, resulting in Aeroquip Products that give dependable performance under the most severe operating conditions.

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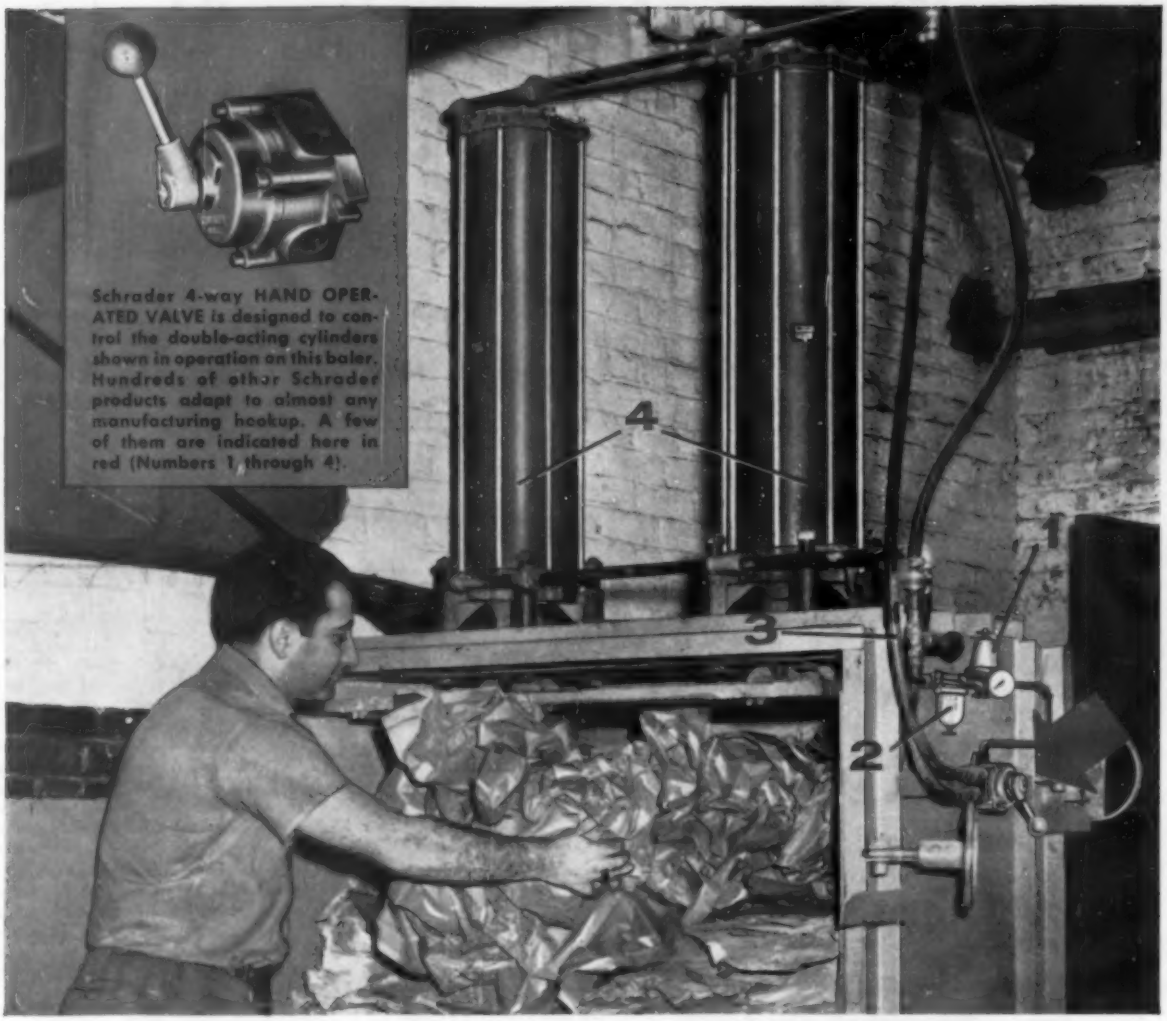
Schrader 4-way HAND OPERATED VALVE is designed to control the double-acting cylinders shown in operation on this baler. Hundreds of other Schrader products adapt to almost any manufacturing hookup. A few of them are indicated here in red (Numbers 1 through 4).
4
1
3
2

How Schrader Air Products bale paper, producing 4 ton pressure with 100 lbs. of air

At this Rhode Island dye works, the paper baling operation formerly was a fatiguing manual chore. Now, the operator simply fills the press with used paper and cartons, and pulls a 4-way hand valve. One hundred pounds of air pressure flowing through the two Schrader double-acting cylinders then compress the paper with four tons of force. Finger-tip adjustments can reduce or raise pressure quickly, easily.

Safe, simple, fast—compressed air daily performs miracles in hundreds of different ways. More and more manufacturers think "air" when they think "automation." Holding work, moving scraps, synchronizing actions—all such operations can be automated with Schrader Air Products.

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new POWERMITE

PUMP and MOTOR COMBINATION

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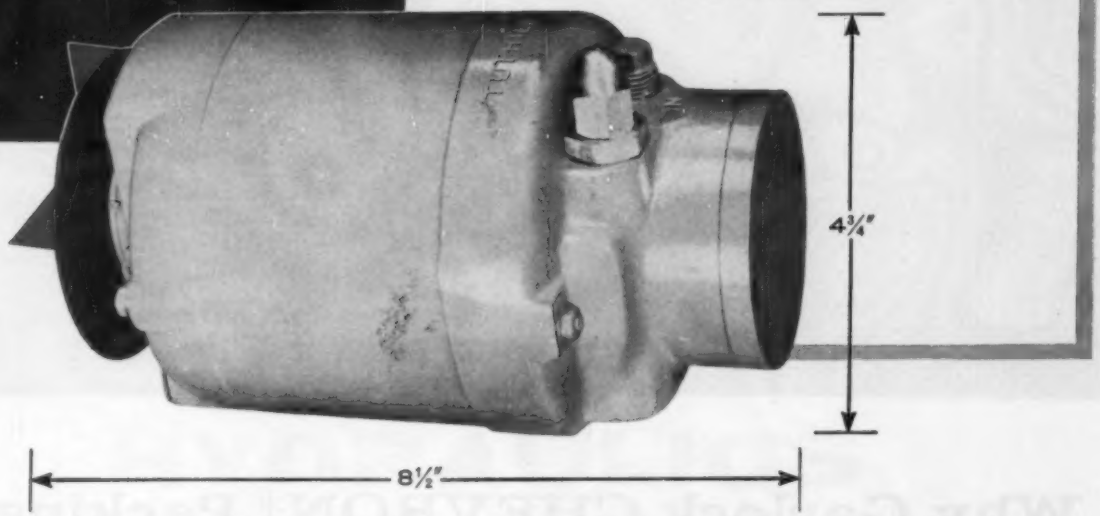

Here's another example of Tuthill's ability to develop the pump to fit the problem. This compact, new Powermite motor-pump combination, a Tuthill exclusive, was developed to meet the requirements of original equipment manufacturers with unusual space and weight limitations.

Motor and cooling blower have, in effect, been incorporated into the internal gear positive displacement rotary pump. The whole unit takes up no more space than a standard electric motor. A single shaft serves all units of the Powermite—and the elimination of couplings, other parts and labor permit substantial economies for OEM applications.

The pump section contains a built-in strainer, and, if desired, an adjustable relief valve. Powermite can be furnished with cooling blower, as illustrated, or it may be supplied with a shaft extension for driving other accessories.

Powermite can be furnished in a wide variety of pump and motor combinations for use in hydraulic, oil burning, lubricating, and other services involving many different fluids. For example, the model illustrated has a capacity of 18 gallons per hour at 300 psi, and is driven by a 1/12 hp motor at a speed of 1750 rpm.

Manufacturers desiring to investigate the cost, space and weight saving advantages of incorporating Powermites into their products are invited to submit detailed specifications. Or, if preferred, a Tuthill representative will call.

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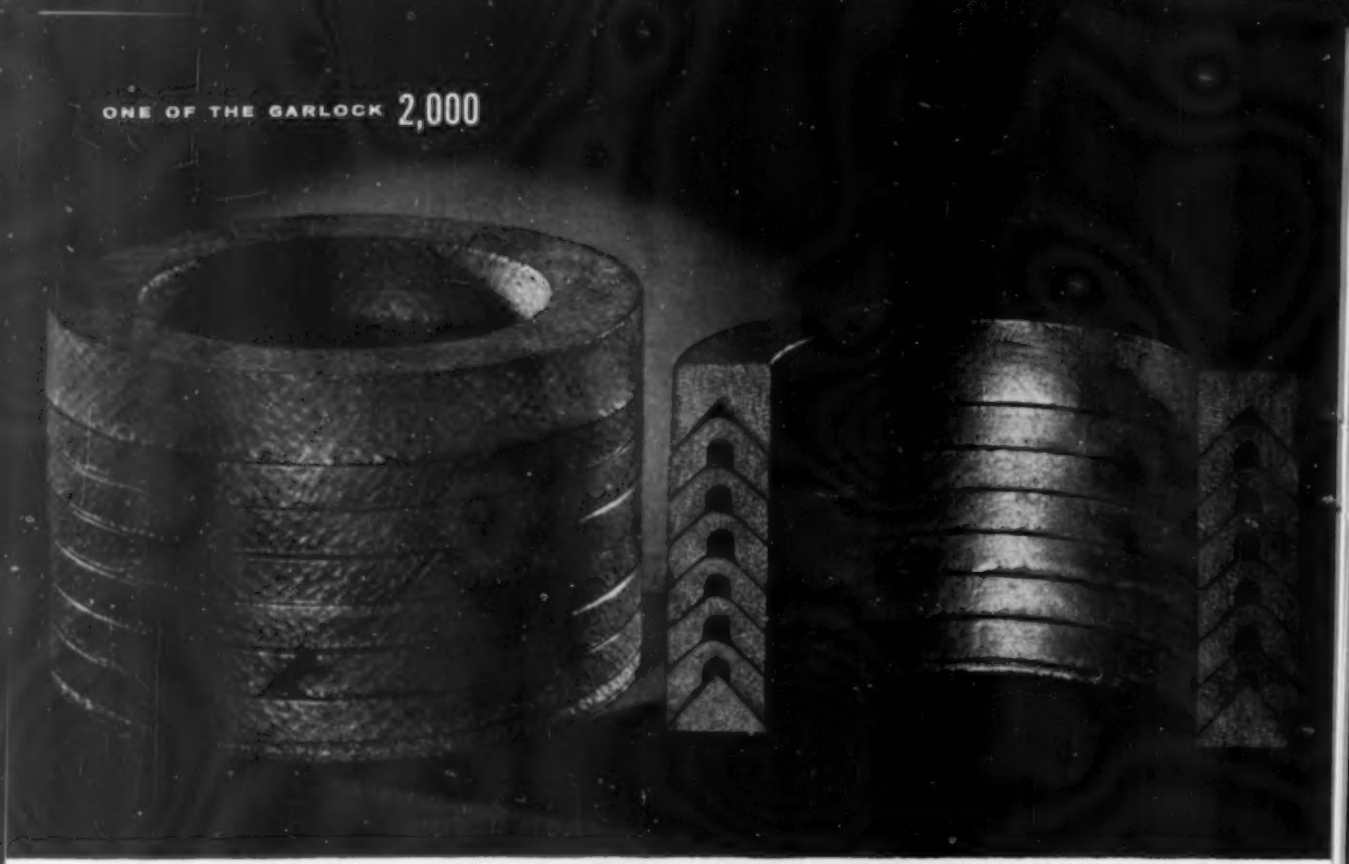
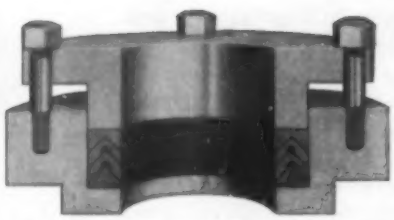


Why Garlock CHEVRON* Packing is really Automatic



This design is entirely different from ordinary V-type packings. CHEVRON has an exclusive hinge-like construction, assuring the automatic action for which it is designed. This also permits the use of less packing in shallower stuffing boxes.

The unique construction of Garlock CHEVRON permits free operation of rods or plungers at all pressures. As pressures increase the packing automatically tightens to prevent leakages. As pressures decline the CHEVRON Rings instantly ease off permitting free operation without leakage.

Therefore, after you make initial adjustment of the gland, no further adjustments are needed to compensate for variations in pressures.

Exclusive CHEVRON is one more part of "the famous Garlock 2,000" . . . two thousand different styles of packings, gaskets, and seals for every need—the only complete line. That is why you get *unbiased* recommendations from your Garlock representative. Call him today or write for CHEVRON Folder AD-115.

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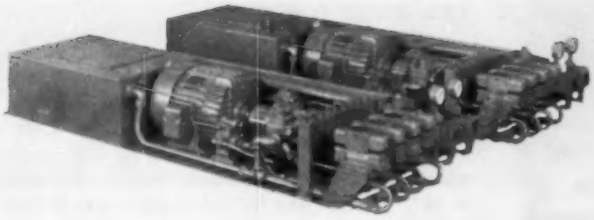

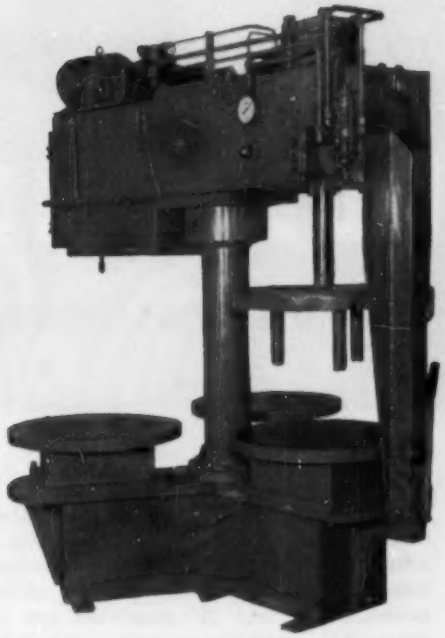

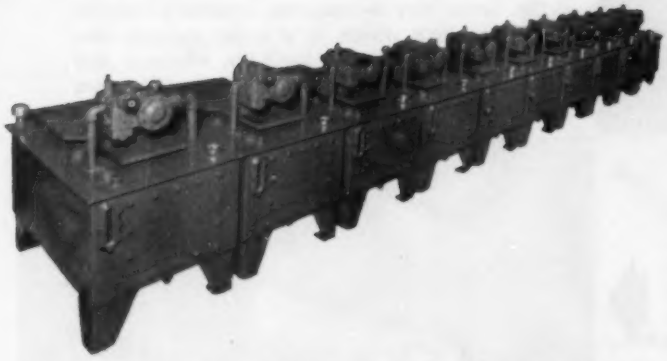

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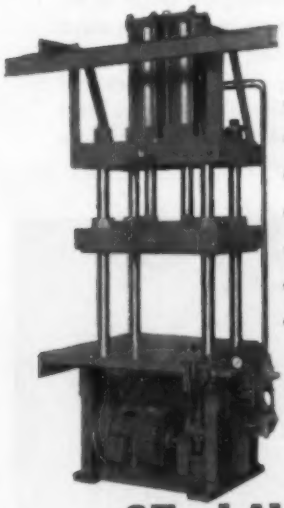

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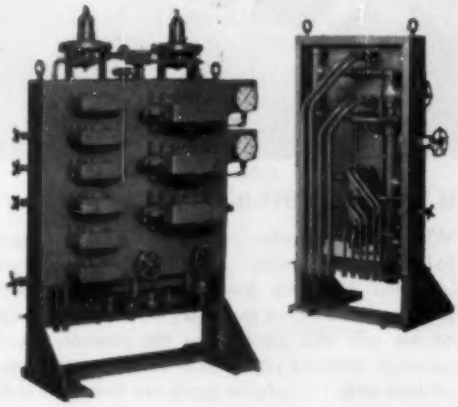

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C SERIES MANIFOLD—

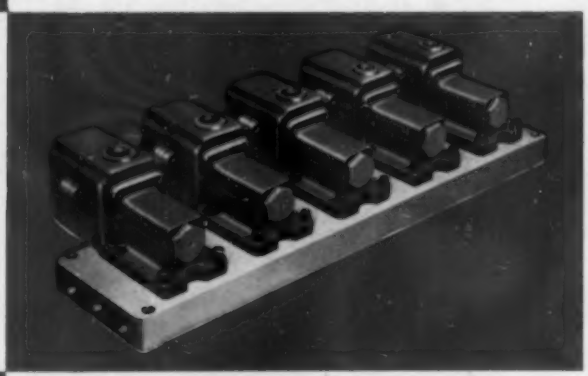
Designed to eliminate separate electrical pull boxes and the confusion of numerous conduit runs, Numatics Conduit Manifold may be used with either M or H Series air manifolds. A selection of from 3 to 6 stations is offered—and all valve actions, in ¼" and ⅜" pipe sizes, are interchangeably mountable on any station. Further, once assembled, the basic installation need never be disturbed, as individual access to any valve in the group is provided for by separate cover plates.

M SERIES MANIFOLD—

For the ultimate in piping flexibility, Numatics offers the Individual Exhaust Manifold Series. The common supply passage, running the length of the manifold, is threaded at both ends. Each exhaust port is threaded one side and bottom . . . allowing unit to be piped from any side or combination of sides. Available in three sizes . . . A for ¼" and ⅜" valves, B for ½" valves, C for ¾" valves—in a minimum of 2, a maximum of 6 stations.

H SERIES MANIFOLD—

Where it is desirable to have all exhausts manifolded into common exhaust chambers, use Numatics H Series Manifold. All exhaust ports join into two exhaust passages which run the length of the unit and parallel to the common supply passage. Exhaust and supply ports are threaded at both ends . . . cylinder ports are threaded in the bottom face, thus permitting piping from the bottom only. H Series manifolds are offered in ¼" and ⅜" sizes in from 3 to 6 stations.



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AIR AND OIL CIRCUIT GUIDE

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Prepared by the Editors of
Applied Hydraulics
the Magazine of Fluid Power

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COMPONENT SYMBOLS

JIC symbols show the function of circuit components. They simplify tracing fluid flow and permit an understanding of the circuit operation.

LINES & COMPONENTS

These symbols represent lines, pumps, actuators, and other units. In addition to a schematic layout of the system, the diagram should include such information as size of piping, operating pressures, pump speed and delivery, and fluid motor speed range and torque rating.

LINES	
LINE, WORKING	
LINE, PILOT	
LINE, DRAIN	
LINE, FLEXIBLE	
CONNECTOR (DOT TO BE 3 X WIDTH OF ASSOCIATED LINE)	
DIRECTION OF FLOW	
LINE, PASSING	
LINE, JOINING (TEE CROSS ETC.) (DOT TO BE 3 X W)	
RESERVOIR (FLUID TANK)	
LINE, TO RESERVOIR ABOVE FLUID LEVEL / BELOW FLUID LEVEL	
MANIFOLD, VENTED	
PLUG OR PLUGGED CONNECTION	
TESTING STATION (GAGE CONNECTION)	
POWER TAKE OFF	
RESTRICTION, CHOKE, FIXED VISCOUS	
RESTRICTION, ORIFICE FIXED NON-VISCOUS	

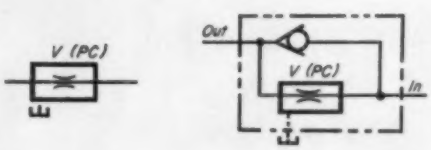
PUMPS	
PUMP, SINGLE FIXED DISPLACEMENT	PF
PUMP, SINGLE VARIABLE, DISPL.	PV

MOTORS AND CYLINDERS	
MOTOR, ROTARY FIXED DISPLACEMENT	MF
MOTOR, ROTARY VARIABLE DISPL.	MV
MOTOR, OSCILLATING	MO
CYLINDER, SINGLE ACTING PLUNGER TYPE	
PISTON TYPE	
CYLINDER, DBLE. ACT. SINGLE END ROD	
DOUBLE END ROD	

MISCELLANEOUS UNITS	
MOTOR, DRIVE, ELECTRIC	ELEC MTR
HEAT EXCHANGER	HE
INTENSIFIER	INT
ACCUMULATOR	ACC
FILTER	FILT
STRAINER	STRN
PRESSURE SWITCH	PR SW
PRESSURE GAGE	
SPRING	
SHAFT ROTATING (ARROW IN FRONT OF SHAFT)	
COMPONENT ENCLOSURE	

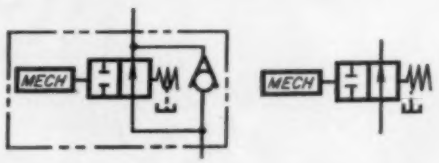
FLOW CONTROLS

Flow Control Valves



Speed of a cylinder or fluid motor is regulated by controlling fluid flow. A simple device for this purpose is a needle valve. Another type of metering valve has a shaft with a half-moon slot acting as a variable orifice. Because rate of flow varies with pressure drop across the valve, flow control valves may include a pressure compensating feature to give constant flow at any setting regardless of work load.

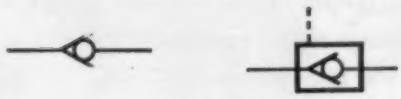
Deceleration Valves



Deceleration valves slow down and stop a cylinder at the end of its travel. Installed in the cylinder line, they permit free flow until actuated by a cam. As the cylinder nears the end of its travel, the tapered cam actuates the valve gradually reducing flow from the cylinder. When provided with a built-in check, the valve permits free return flow.

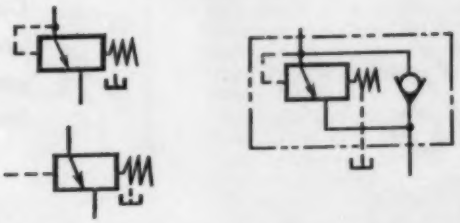
DIRECTIONAL CONTROLS

Check Valves



Check valves permit free flow in one direction and block flow in the opposite direction. The valve consists of a ball or poppet held against its seat by a light spring. Flow in one direction unseats the ball with little pressure loss. Flow in the opposite direction is blocked by the seated ball. Pilot-operated check valves permit reverse flow when the ball is unseated.

Sequence Valves

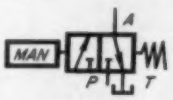


Sequence valves are normally-closed, pressure-actuated units which open to permit free flow when the pressure setting is reached. They may be actuated either by pressure at the inlet or remote pressure. Reverse flow can be provided by an integral check valve.

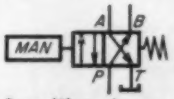
Directional Valves

Directional valves may be either 2, 3, or 4-way depending on the number of connections to the valve. The valves may have 2, 3, or more positions indicated by the sets of arrows which show direction of flow. The method of actuating the valves such as manual, mechanical, air-pilot, hydraulic-pilot, solenoid, and others is indicated in a box.

Solenoid-controlled, pilot-operated valves are shown in two sections enclosed in one unit. All solenoid valves are shown in the de-energized position, and spring loaded valves are shown with connections to the deactuated position. These symbols represent part of the many available types of directional valves.



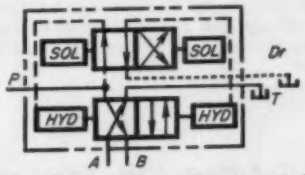
2-position, 3-way



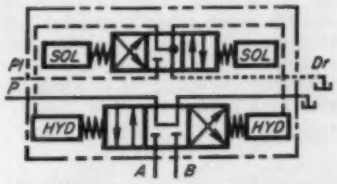
2-position, 4-way

3-position, 4-way, open-center

3-position, 4-way, closed-center



Solenoid-controlled, pilot-operated, 2-position



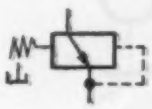
Solenoid-controlled, pilot-operated, 3-position

PRESSURE CONTROLS

Relief & Unloading Valves

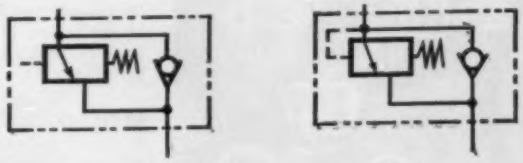
Relief valves, also called safety or maximum pressure valves, limit system pressure by directing oil to tank when the pressure setting of the valve is reached. Unloading valve dumps oil back to tank at near zero pressure when pilot pressure from another source acts to hold open the unloading valve.

Pressure Reducing Valves



Pressure reducing valves are normally-open units which balance a preset spring pressure against the output pressure. Reduced output pressure is maintained constant.

Counterbalance Valves

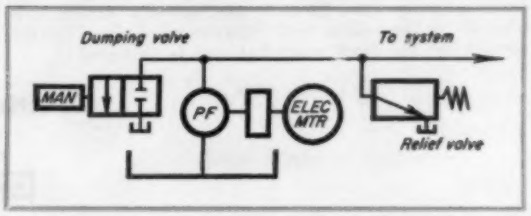


Counterbalance valves maintain back pressure on a cylinder to prevent lunging when the load is suddenly relieved. They also prevent a vertical ram from dropping due to gravity. These normally-closed valves may be either directly or remotely operated. An integral check valve permits free flow in the reverse direction.

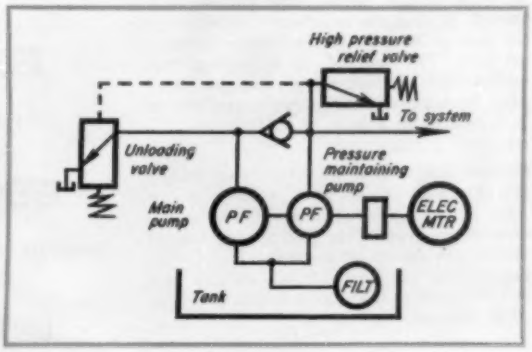
PUMP UNLOADING CIRCUITS

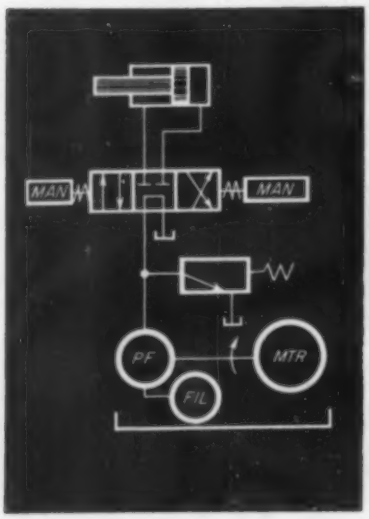
During periods when no flow is required in a hydraulic system, the pump output can be returned to tank at low pressure. This reduces power consumption and heat, and increases pump life and system efficiency.

MANUAL CONTROL—A manually operated 2-way valve can be connected to unload the pump. This places responsibility on the operator to unload the system when no pump flow is required. In this circuit the entire system is connected to tank through the manual valve.



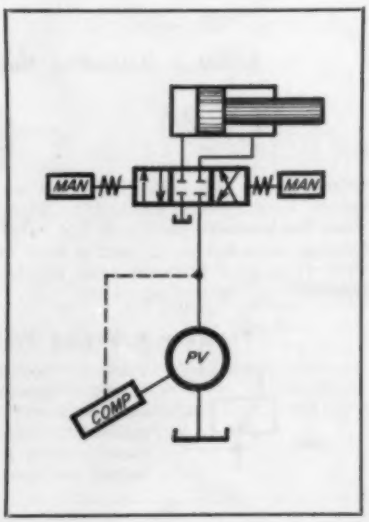
HI-LO CIRCUIT—Many systems require a high volume and low pressure for rapid traverse of a vise or tool, and then low volume, high pressure for clamping or feeding. This can be accomplished by a hi-lo circuit using two pumps. During rapid traverse both pumps supply the system. When the pressure rises during clamping or feed, the large volume main pump is unloaded, and the small pump maintains pressure. The delivery of the small pump is kept low enough to prevent appreciable heating of the oil. Instead of pilot operation, the unloading valve can be solenoid controlled and actuated by a pressure switch.

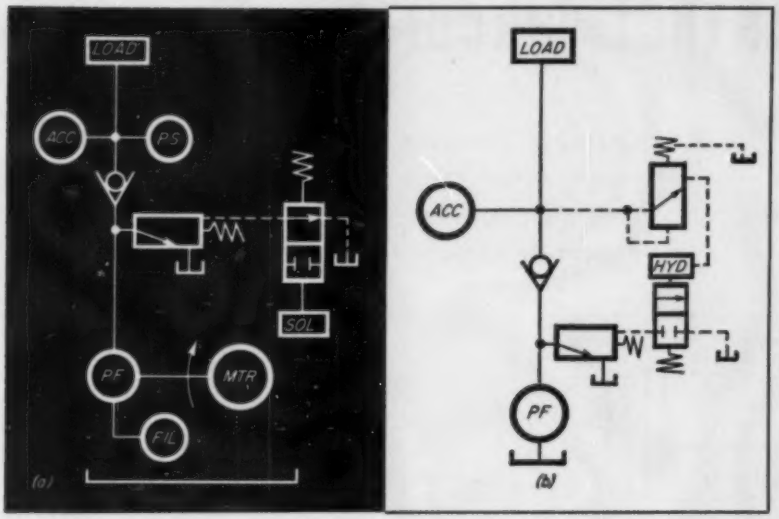




OPEN-CENTER SYSTEM—In the open-center system, pump output is connected through the directional valve to tank. When this circuit is used with small flows, and the directional valve spool has tapered lands, the circuit provides a simple, efficient system. When several cylinders are included, the valves can be connected in series; that is, the tank port of one valve is connected to the pressure port of the next.

PRESSURE-COMPENSATED PUMP—A pressure-compensated, variable-volume pump is controlled by system pressure. As pressure increases, displacement of the pump decreases, so that pump output at the preset pressure is only sufficient to make up for leakage. Used with a closed-center valve, the pump is stroked to minimum displacement when valve is centered.



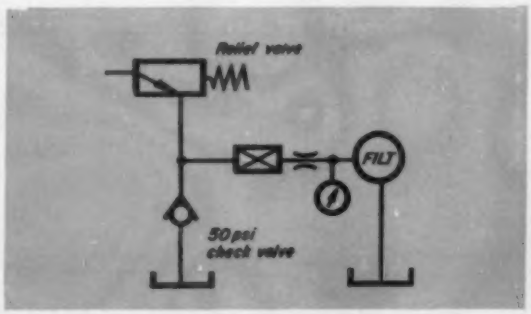


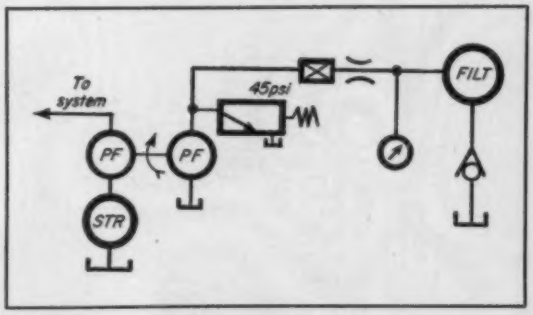
PILOT-OPERATED RELIEF— Use of a pilot-operated relief valve gives fast action at the preset pressure with very low unloading pressure. The main spool of the valve is held closed by a spring and balanced pressures. Opening the pilot connection unbalances the spool allowing it to open quickly.

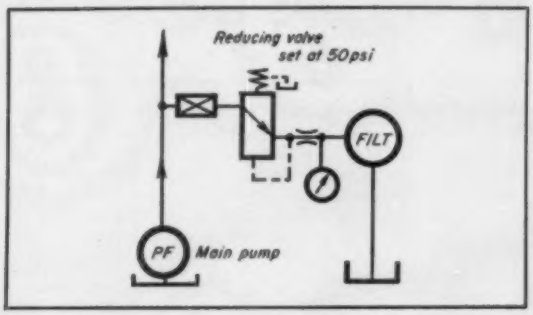
In these circuits the pilot is opened to tank through a 2-way valve operated by a solenoid or pilot pressure. The solenoid is actuated by a pressure switch in circuit (a). The pilot operated valve in circuit (b) is controlled through a sequence valve set for maximum system pressure. Accumulator and check valve maintain system pressure during unloading.

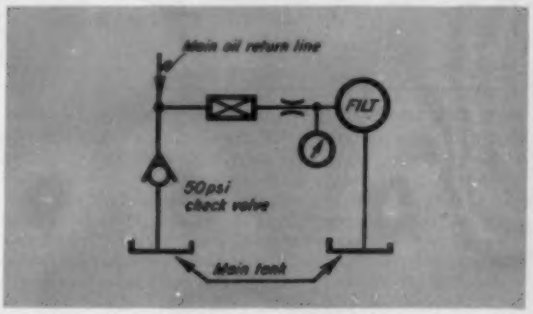
FILTER CIRCUITS

In addition to a filter in the pump intake line, a bypass filter may be installed in the system. This may be connected in parallel with a protective check valve in the relief valve drain line or the main drain line. Bypass filters should be capable of filtering all system fluid within eight hours.



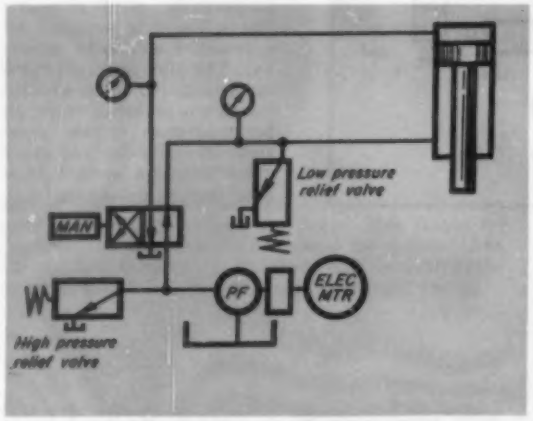




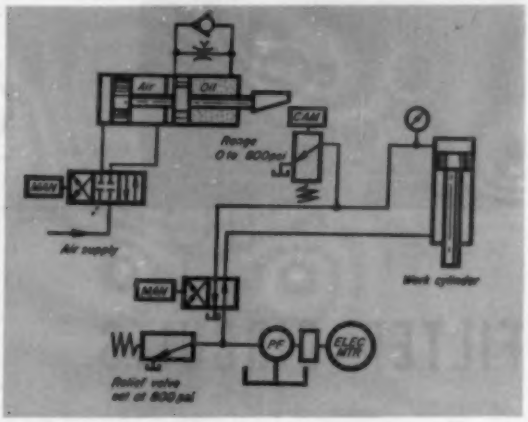


PRESSURE CONTROL CIRCUITS

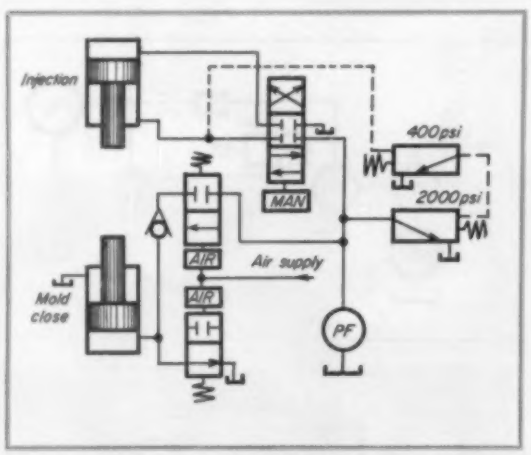
Control of pressure in a fluid power system permits control of output force and torque. Hydraulic pressures generally range from about 150 psi to 3000 psi. Compressed air is usually supplied at 80 to 125 psi.



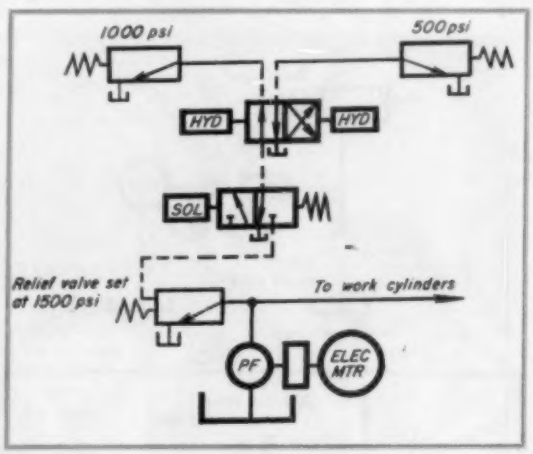
TWO RELIEF VALVES—The use of two relief valves in this circuit gives two working pressures. On the up-stroke of the cylinder the low pressure relief valve controls the pressure. On the down-stroke the high pressure valve limits maximum press tonnage for doing work. Use of the low pressure relief on the up-stroke results in a power savings by holding up the ram with low-pressure fluid.



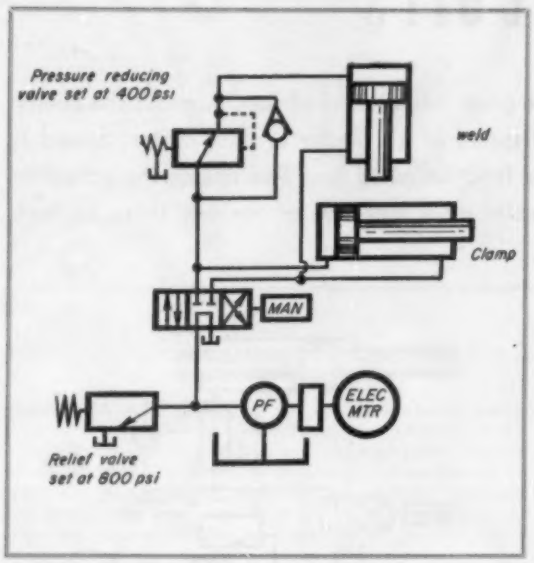
VARIABLE PRESSURE—Changing the setting of the relief valve regulates the system pressure as the work cylinder advances. This is accomplished with a cam-operated relief valve and a combination air-oil cylinder with controlled feed. Operating the 3-position manual valve extends or retracts the combination cylinder to increase or decrease system pressure. Increase of pressure is slow, regulated by the variable orifice.



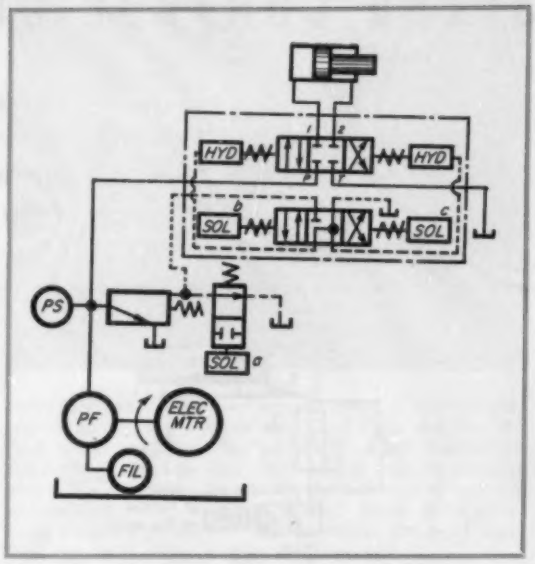
TWO PRESSURES—Pilot-operated relief valves provide two pressures for the mold-close cylinder and the injection cylinder of this plastic molding machine circuit. With the manual valve in neutral, the air-operated valves are actuated to extend the mold-close cylinder at a maximum pressure of 2000 psi. Operating the manual valve to extend the injection cylinder vents the 400-psi relief to tank and vents the 2000 psi relief at 400 psi. High-pressure fluid is held by the check valve.



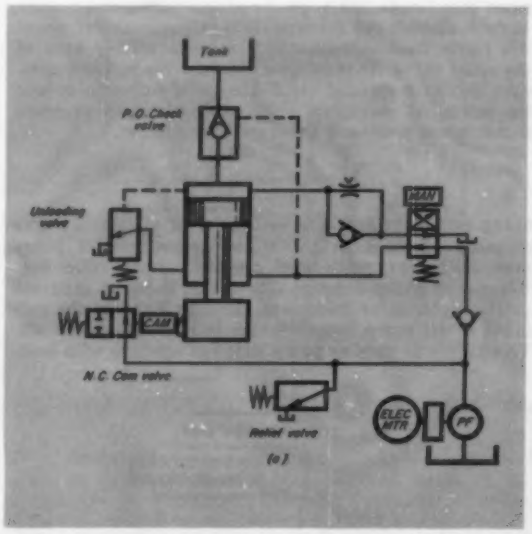
REMOTE CONTROL—Regulating pump pressure from a remote station can be accomplished by using small, pilot relief valves connected to the pilot-operated relief valve. With the 3-way solenoid valve de-energized system pressure is limited to 1500 psi in this circuit. Energizing the solenoid valve permits venting the relief valve to either 1000 psi or 500 psi depending on the position of the 4-way valve which selects either of the two pilot relief valves.

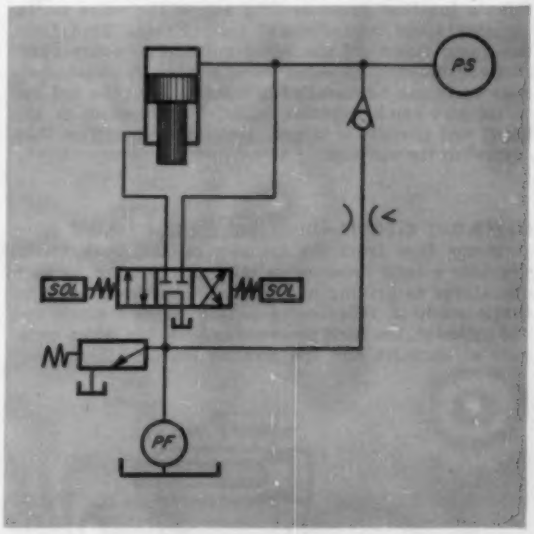


REDUCED PRESSURE—In a system with only one pump, reduced pressure for one branch of the circuit can be obtained with a pressure reducing valve. This circuit is typical for a welder which requires high clamping force, set by the relief valve and reduced force on the welding gun, set by the pressure reducing valve. The check valve in parallel with the pressure reducing valve permits free return flow for retraction of the weld cylinder.



SURGE CONTROL—Smooth build-up of pressure is a feature of this circuit. Actuating solenoids *a* and *b* together allows system pressure to increase to a value required to shift the 4-way valve. When the valve has completely shifted, pressure continues to increase according to the load. This circuit prevents suddenly applying a high pressure to the cylinder. The pressure switch prevents actuation of solenoids *a* and *c* until system pressure has dropped to unloading value with the 4-way valve in the neutral position.



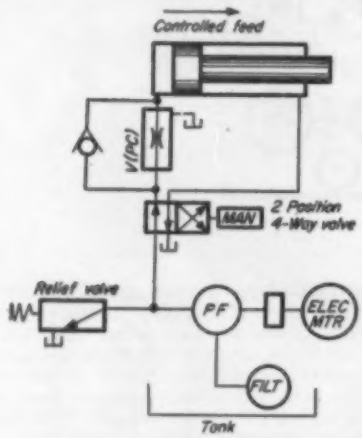


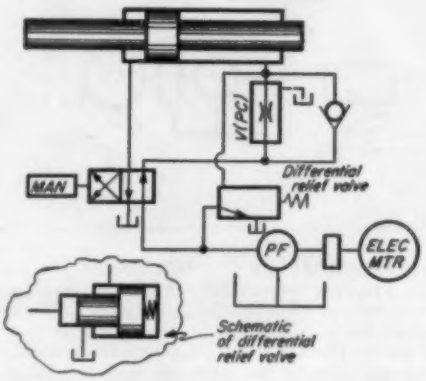
DECOMPRESSION—Sudden release of pressure fluid can result in high pressure surges because of the elasticity of machine members, compressibility of fluids, and inability of relief valves to react fast enough. When the 4-way valve in circuit (a) is released with the cylinder at the bottom of its stroke, high pressure fluids flows slowly through the variable orifice, gradually reducing pressure. During this time the pump output flows through the cylinder rod end and the unloading valve. With the cylinder at the top of its stroke the cam-actuated valve is opened to unload the pump.

In circuit (b) representing a plastics press, the pressure switch is actuated when pressure builds up with the cylinder extended. This starts a timed cure period at the end of which the solenoid valve is deactuated. High pressure fluid then drains from the head end of the cylinder through the variable orifice, and the pump is unloaded through the open-center valve.

SPEED CONTROL CIRCUITS

One of the great advantages of fluid power is the ability to control speed of a cylinder or fluid motor. Speed is primarily a function of oil flow and size of the actuator. These circuits show methods of varying these factors.



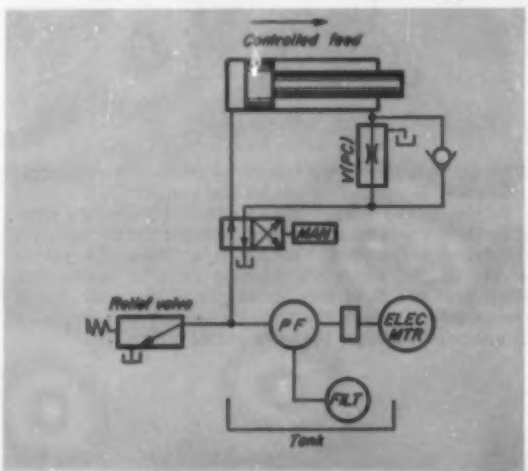


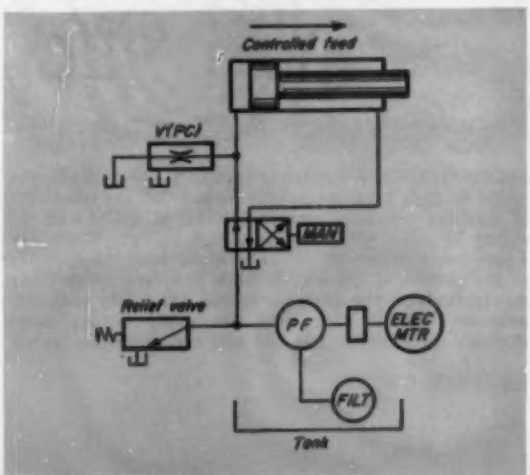
METER-IN CIRCUIT—A flow control valve is connected to meter flow to the cylinder during the work stroke. Using a pressure-compensated flow control valve maintains a constant pressure drop across the valve and a constant speed regardless of load. Excess fluid from the pump flows off the relief valve. The pump operates continuously at relief valve setting. A counterbalance valve can be installed in the line from the rod end to support small negative loads. Flow control in the blank end permits a larger, more reliable orifice than control in the rod end.

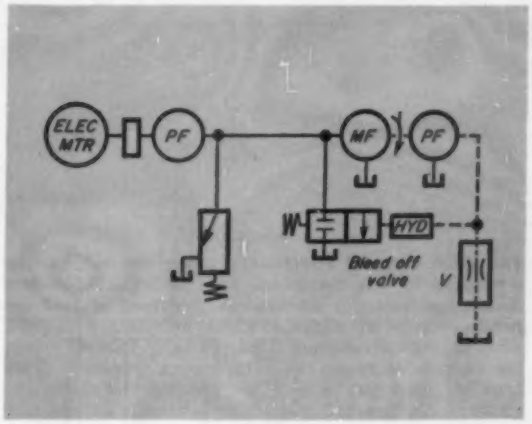
METER-OUT CIRCUIT—Installing the flow control valve to meter flow from the cylinder on the work stroke provides a back pressure to minimize lunging on such operations as drilling and milling. The pump operates continuously at relief valve setting. With a single rod end cylinder, the back pressure exceeds the pump pressure at negative and low positive loads.

DIFFERENTIAL RELIEF VALVE—By connecting cylinder outlet pressure into a differential relief valve, inlet pressure can be made to vary with the load. This eliminates one disadvantage of the simple meter-out circuit, while retaining the feature of back pressure for negative loads. Back pressure acts on an auxiliary area of the relief valve. At maximum negative loads, back pressure is maximum and opens the relief valve to unload the pump. At maximum positive loads, pump pressure is maximum and back pressure is minimum.

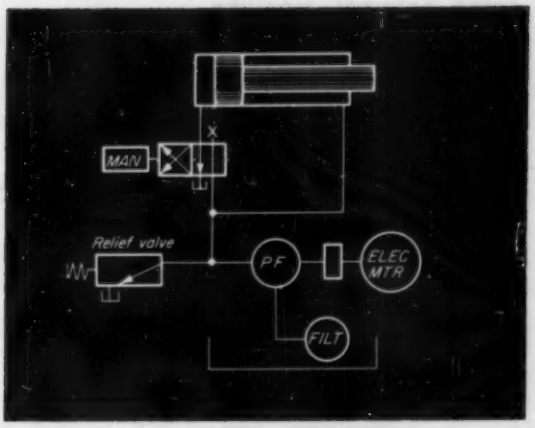
BLEED-OFF CIRCUIT—Connecting a flow control valve to bleed off fluid on the work stroke permits pump pressure to vary with work load improving efficiency. Because of pump slippage this circuit is not as accurate as the meter-in or meter-out circuits. Flow to the cylinder is the pump output which is left after bleed off. This flow will vary as pump slippage changes with load.



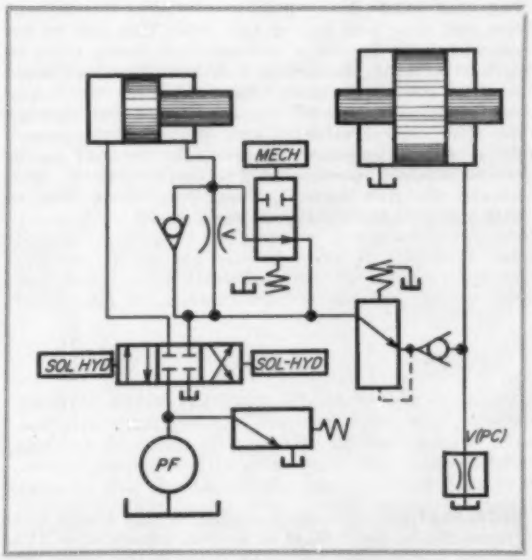




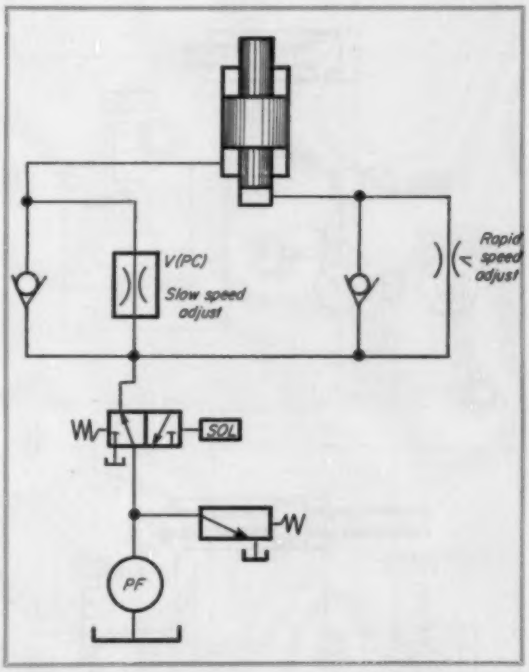
FLUID MOTOR SPEED—The use of an auxiliary pump and flow control valve eliminates the effects of oil compression and slip in this circuit. Any speed change of the fluid motor produces a corresponding change in auxiliary pump output varying the pressure between the pump and flow control valve. This pressure actuates the bleed-off valve to maintain a constant fluid motor speed.



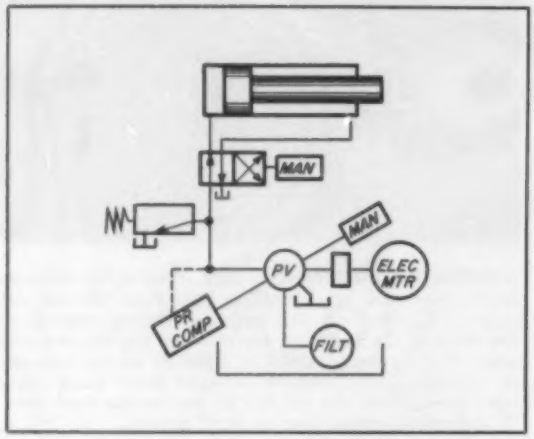
DIFFERENTIAL CIRCUIT—Forward speed of the cylinder can be increased by connecting fluid from the rod end back to the head end. The increase in speed depends on the ratio of the head-end area to the rod-end annular area. The increased speed is obtained at the expense of working force, because forward force must overcome pressure in the rod end as well as the work load. This circuit is often used on small presses.



DUAL CYLINDERS—Metering fluid at rates of less than 5 cu. in./min. can be troublesome, and rates of 50 to 100 are recommended. The small cylinder provides a fast approach to the work and the larger cylinder provides adequate meter-out flow for accurate feed. The deceleration valve closes at the end of the small cylinder stroke and forces the cylinder discharge through the meter-out flow control valve to slow down the cylinder before it contacts the larger cylinder. On the return stroke fluid is supplied through the pressure reducing valve to return the large cylinder for the next stroke.

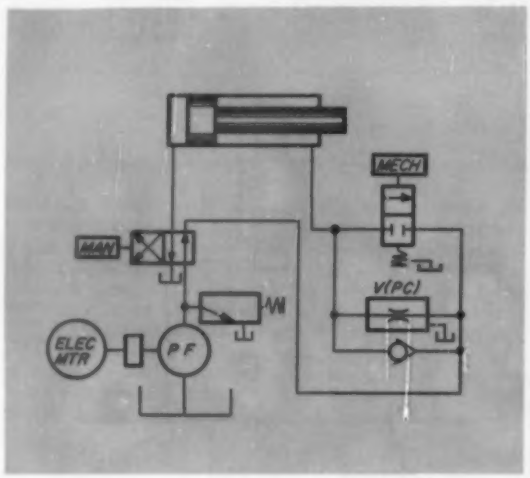


GRAVITY FEED—Construction of the cylinder provides a simple method of obtaining rapid approach and slow feed. With the solenoid valve actuated the cylinder drops by gravity draining through both flow control valves at a speed controlled by the larger rapid-speed adjusting valve. When the piston rod enters the small end of the cylinder, fluid from the large end of the cylinder must pass through the slow-speed adjusting valve. The two check valves provide free return flow for raising the cylinder.

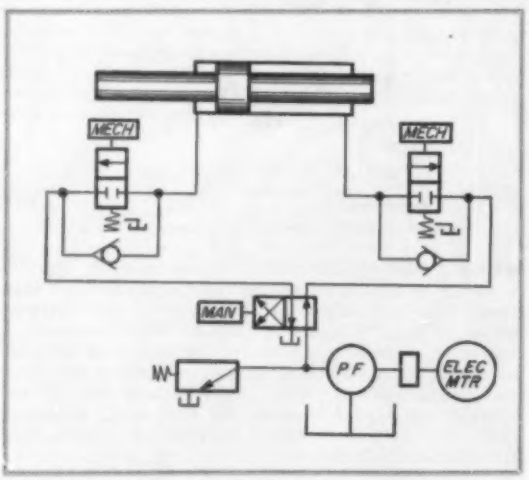


VARIABLE VOLUME PUMP—The pump delivery can be controlled by various means such as manual, electric motor, hydraulic, or mechanical. Accuracy of feed depends upon pump slippage which increases with load. With a pressure-compensated, variable-volume pump, the output decreases with increasing pressure. This type of pump can be used for traverse and clamp operations. An external relief valve is usually unnecessary when a pressure-compensated pump is used.

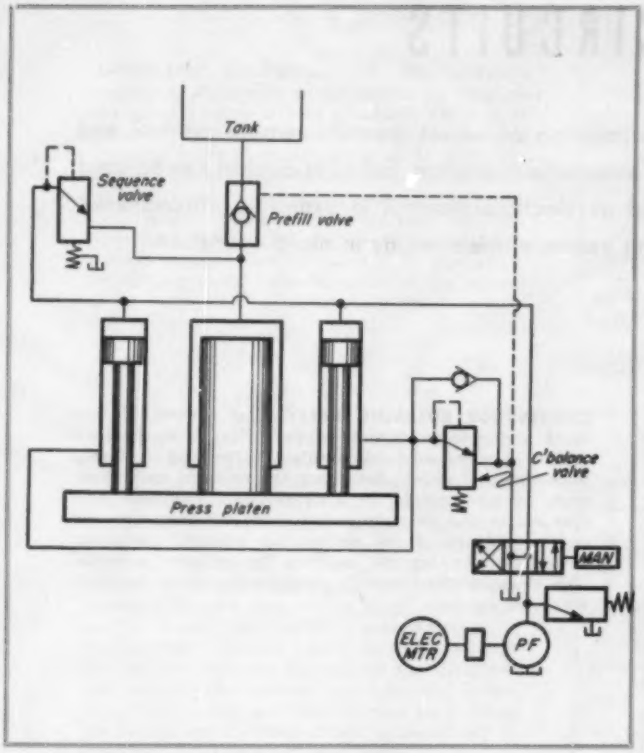
Several different types of compensator controls are available. One, a dual-pressure control, permits shifting the pump to minimum displacement at either a high or low system pressure. This control may be pilot or electrically operated to select either pressure at which the pump displacement is reduced.

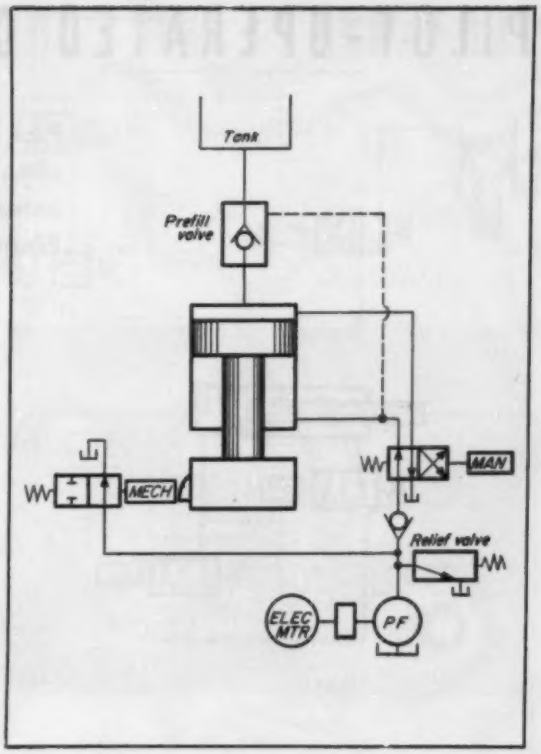


VARIABLE FEED—Many machines require intermittent fast and slow feed during the cycle. This can be accomplished by having a cam-operated 2-way valve in parallel with the meter-out flow control valve. Rapid forward movement takes place any time the 2-way valve is open. Closing off the valve forces flow through the flow control valve slowing down cylinder speed. By proper arrangement of cams, the required speeds can be obtained in sequence. The check valve in parallel with the flow control permits free return flow, so that the cylinder returns at rapid speed.



DECELERATION—Cylinders moving at high speeds must frequently be decelerated to a slow, smooth stop. Connecting a cam-operated 2-way valve in the output line of a cylinder permits slowly closing off oil flow from the cylinder. In this circuit with a double-rod cylinder, cam-operated valves are installed in both lines to the cylinder to provide deceleration in both directions. Cushions built into the end caps of the cylinder would perform the same function. However when a cylinder must be stopped before the end of its stroke, external deceleration valving is required.

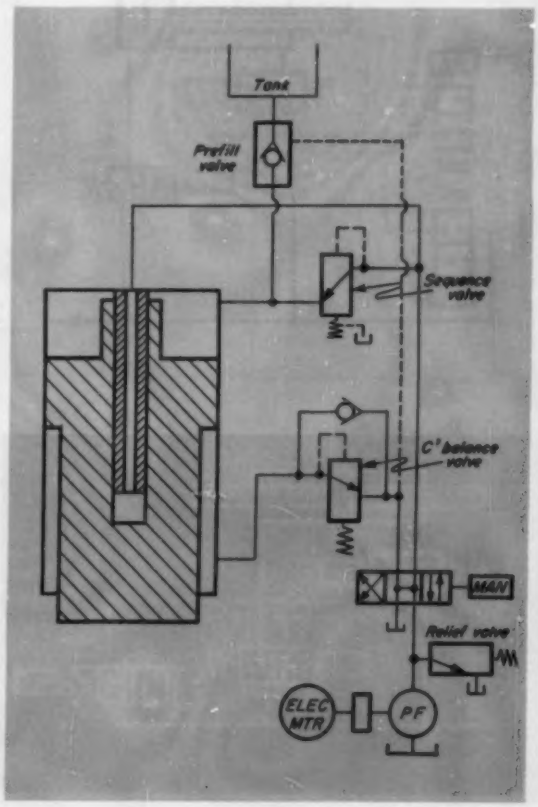




AUXILIARY CYLINDERS AND PREFILL—On a press which requires a large cylinder for the necessary force, the platen lowering speed can be increased by using smaller auxiliary cylinders, called kicker cylinders. Operating the manual valve directs pump output to these two cylinders while the main cylinder prefills by drawing in fluid from the tank. This minimizes the required pump size. When the kicker cylinders bottom, the sequence valve opens and pressure is applied to the main cylinder. When the manual valve is shifted to raise the platen, pilot pressure opens the prefill valve and fluid from the main cylinder is directed back to tank.

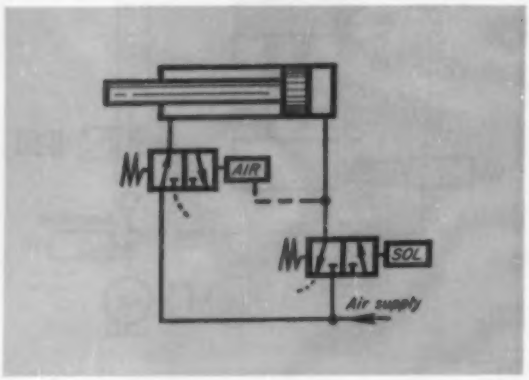
GRAVITY RAPID TRAVERSE—If the weight of the ram and dies is sufficient to overcome friction and permit the ram to descend by gravity at the required rate, kicker cylinders can be eliminated. The counterbalance valve is also eliminated. The manual valve cannot be a three position open-center type to unload the pump, because it would permit the ram to lower in the neutral position. The pump is unloaded through the 2-position, cam-operated valve when the ram is up. The check valve then traps fluid to hold the ram up.

INTERNAL CYLINDER—Where space limitations make kicker cylinders impractical, a main cylinder with an axial bored hole accomplishes a similar action. The prefill system operates the same as the circuit above. Boring out the main ram provides a reduced area with a correspondingly higher speed at the pump output rate. Small return area on the main ram assures rapid opening of the press.

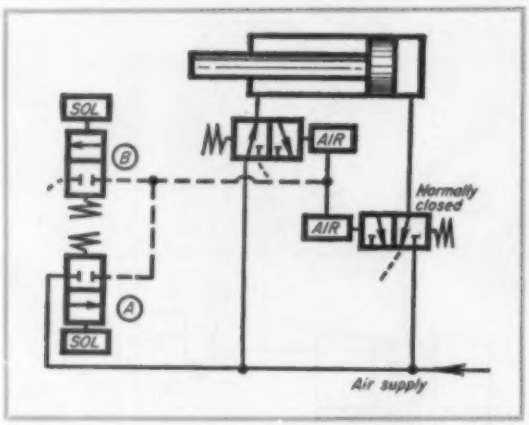


PILOT-OPERATED CIRCUITS

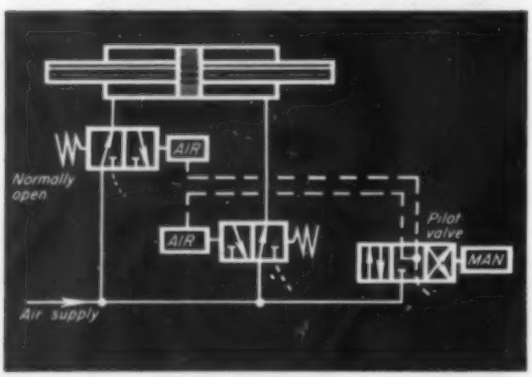
Pilot operation of valves permits remote control and often automatic operation. Full pilot control can be used instead of electrical control in explosive atmospheres. Piloting valves with air results in rapid operation.



CONTINUOUS SOLENOID VALVE—The control of forward and reverse motion of the cylinder is obtained with a 3-way, solenoid-operated valve and a 3-way pilot-operated valve. Actuating the solenoid valve connects air pressure to the head end of the cylinder and also shifts the pilot-operated valve opening the rod end to exhaust. De-actuating the solenoid valve reverses the connections, so that the cylinder retracts. The solenoid must remain energized during the forward stroke.

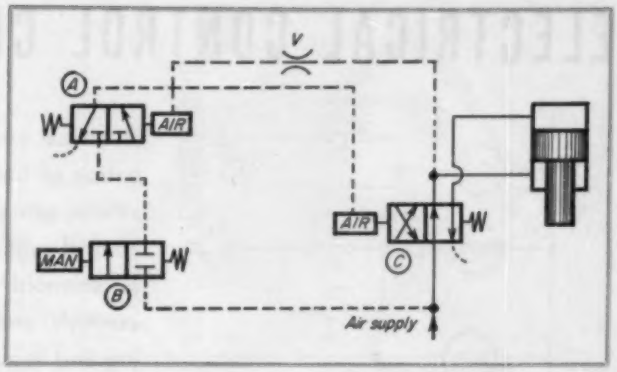


MOMENTARY SOLENOID—The two solenoid-operated valves control actuation of the pilot-operated valves which in turn control air flow to the cylinder. In the condition shown, the cylinder is held retracted. Momentarily actuating valve (A) shifts both pilot-operated valves to extend the cylinder. Pilot pressure is maintained on the valves until valve (B) is actuated to exhaust this pressure and permit the air-operated valves to return to their spring-loaded positions. Because the solenoid-operated valves handle only pilot pressure, they are minimum size.

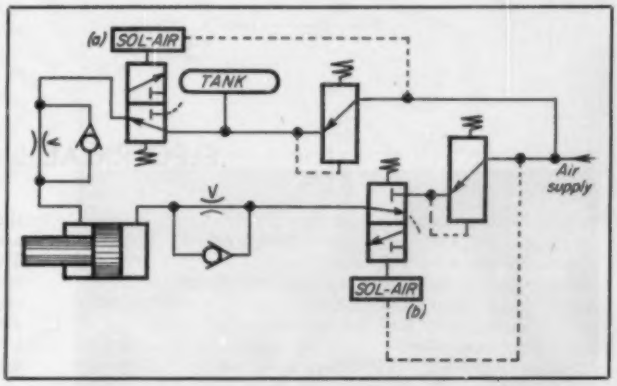


MANUAL CONTROL—Use of a 4-way, 3-position manual valve permits stopping the cylinder at any point in its travel. Shifting the valve to neutral position exhausts air from both pilot-operated valves and applies air pressure to both sides of the cylinder. Shifting the manual valve to either extreme position actuates one of the pilot-operated valves to exhaust one side of the cylinder. One 4-way valve could be used instead of the two 3-way valves. However mounting the 3-way units close to the cylinder ports provides fast action.

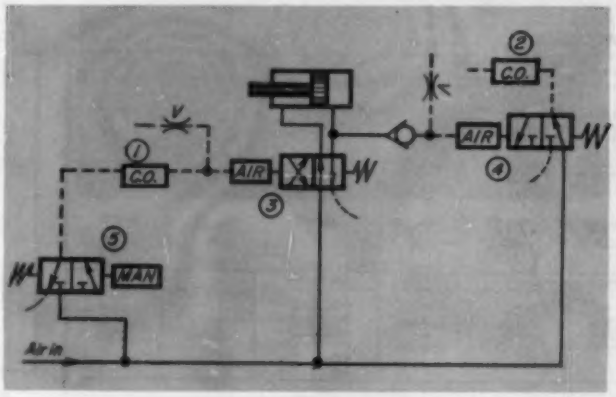
AUTOMATIC RECIPROCATION—This circuit maintains automatic reciprocation as long as the manual valve is held actuated. Valve A is actuated when air is connected to the system. Opening valve B causes valve C to shift extending the cylinder. In addition, the pilot of valve A is connected to exhaust through the flow control valve. When sufficient air has exhausted from valve A, the valve shifts to retract the cylinder. If valve B is held open, the cycle repeats. Cylinder dwell at the bottom of its travel can be adjusted by the flow control valve.



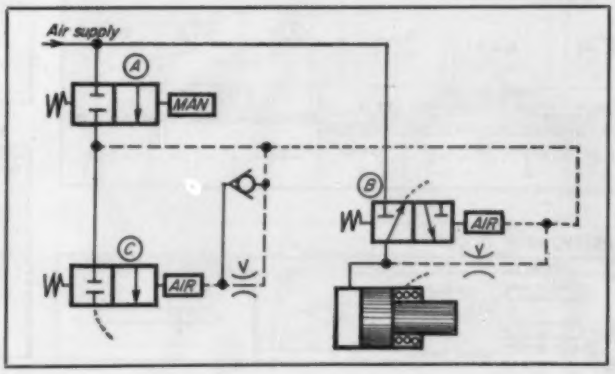
ADEQUATE PILOT PRESSURE—Main line pressure acting on a pilot-operated poppet-type valve opposes the force developed by the pilot pressure. To insure valve shift, adequate pilot pressure must be applied. In this circuit the pressure reducing valves provide independently regulated pressure on the cylinder rod and head ends. Connecting an external pilot line ahead of the reducing valves keeps pilot pressure at the highest possible value. During the forward feed solenoid (a) is de-energized and the cylinder extends because of the differential between the rod end and head end areas. Air from the rod end fills the line tank. Near the end of the forward stroke, solenoid (a) is energized for rapid cylinder travel.



DELAYED BLOW-OFF—The cut-out valves used in this circuit are 2-way valves which pass a preset amount of air and then close. Operating manual valve 5 actuates 4-way valve 3 to extend the cylinder. This operates valve 4 to exhaust air ahead of valve 2. After cut-out valve 1 closes, the pilot of valve 3 begins a timed exhaust and then deactuates. The cylinder retracts and valve 4 begins a timed exhaust. Valve 4 then shifts to permit a specific amount of air to pass through cut-out valve 2.



CYLINDER DWELL—Time delay in this circuit is regulated by the flow control valves and begins when the manual valve is opened. Momentarily actuating valve A shifts valve B to extend the cylinder. Air continues to supply the pilot of valve C through valve B and the flow control valves. When valve C shifts, the pilot line is exhausted permitting valve B to shift retracting the cylinder. The delay is not dependent on the operator releasing valve A immediately.



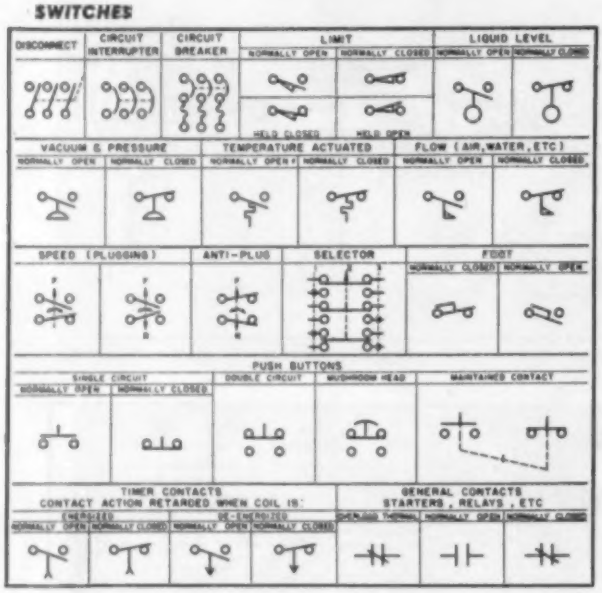
ELECTRICAL CONTROL CIRCUITS

Electrical control permits great versatility in the application of fluid power. Limit switches sense cylinder positions, pressure switches sense system pressures, timers control cylinder dwell, and relays actuate hydraulic and air solenoid valves. These components, with pushbutton controls, and other electrical units provide the interlocking and sequencing required in many applications.

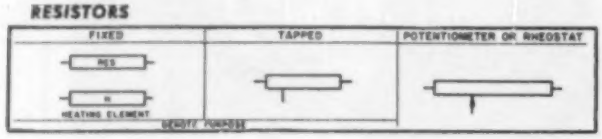
ELECTRICAL SYMBOLS

To establish a common language for reading electrical diagrams, the JIC has adopted these symbols. The diagrams are drawn in "ladder" format in which the left side represents the power lead and the right side represents the ground lead. Components are shown connected across these two leads. Components which have more than one position such as relays, limit switches, pressure switches, and timers are usually shown in the deactuated or reset position. Contacts of relays are designated the same as the corresponding coil. Thus, if the coil is designated as 1-CR, all contacts of the relay are also labeled 1-CR. Solenoids should be labeled the same on the electrical and fluid power diagrams. The means by which limit switches are actuated should be indicated on the electrical or fluid power diagram.

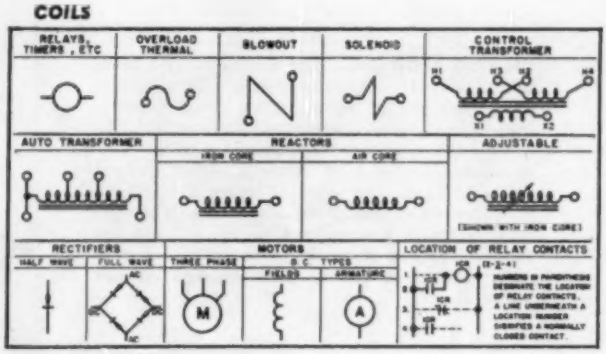
SWITCHES



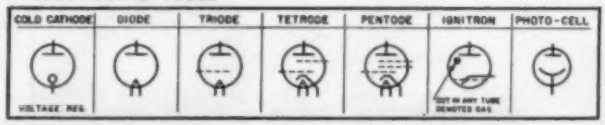
RESISTORS



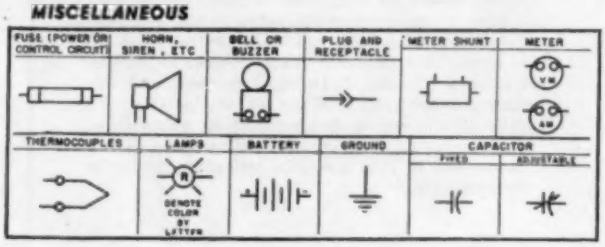
COILS



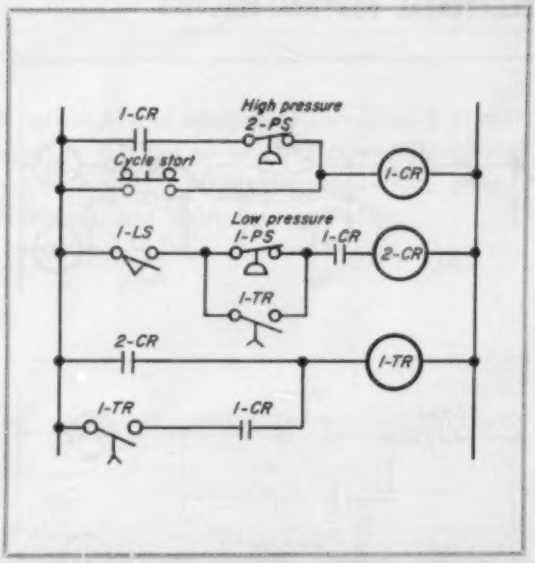
ELECTRONIC TUBES



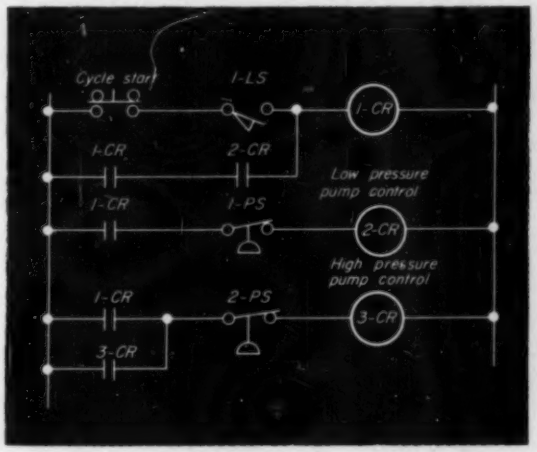
MISCELLANEOUS



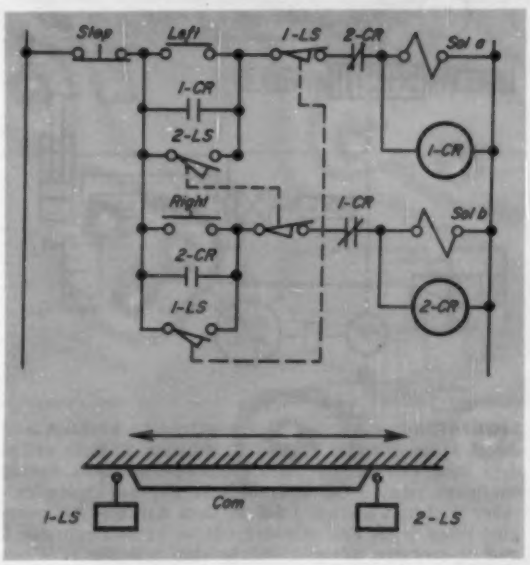
TWO PRESSURES—The combination of pressure, position, and time elements is illustrated in this circuit to control one source at two pressures. With relay 1-CR actuated by the CYCLE START switch, limit switch 1-LS closes starting the timer when the cylinder contacts the work. Pressure rises to open pressure switch 1-PS deactuating relay 2-CR which de-energizes a solenoid valve to release pressure on the cylinder. When the pressures drops, pressure switch 1-PS closes actuating relay 2-CR to advance the cylinder. This cycle of increasing and decreasing pressures continues until the timer times out and its contacts in parallel with pressure switch 1-PS close. Pressure then rises to the setting of pressure switch 2-PS. The opening of 2-PS opens the interlock for 1-CR and the cylinder returns to its initial position for the next cycle.

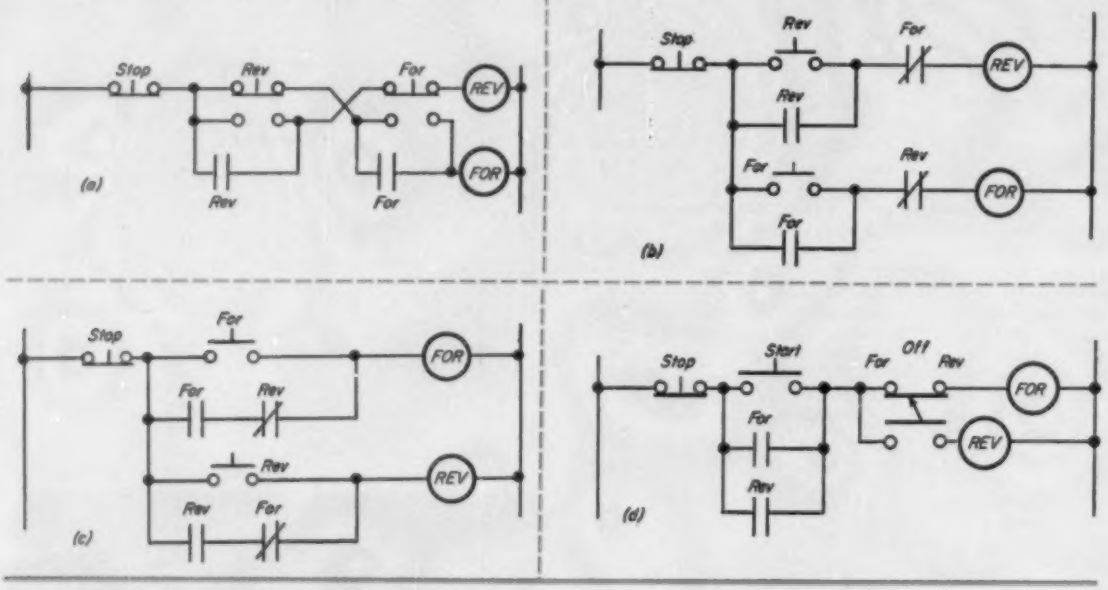


TWO-PUMP CONTROL—This circuit provides control of a hi-lo circuit. Limit switch 1-LS is held closed in the machine starting position. The CYCLE START switch energizes relay 1-CR which in turn energizes both the low and high pressure control systems. Pressure switch 1-PS opens at the low pressure setting de-energizing relay 2-CR and relay 1-CR. The high pressure system has been interlocked through its own relay contact 3-CR. At the high pressure, 2-PS opens de-energizing relay 3-CR. The pressure control system is now inactive until the equipment is back to its original starting position when 1-LS is again closed.

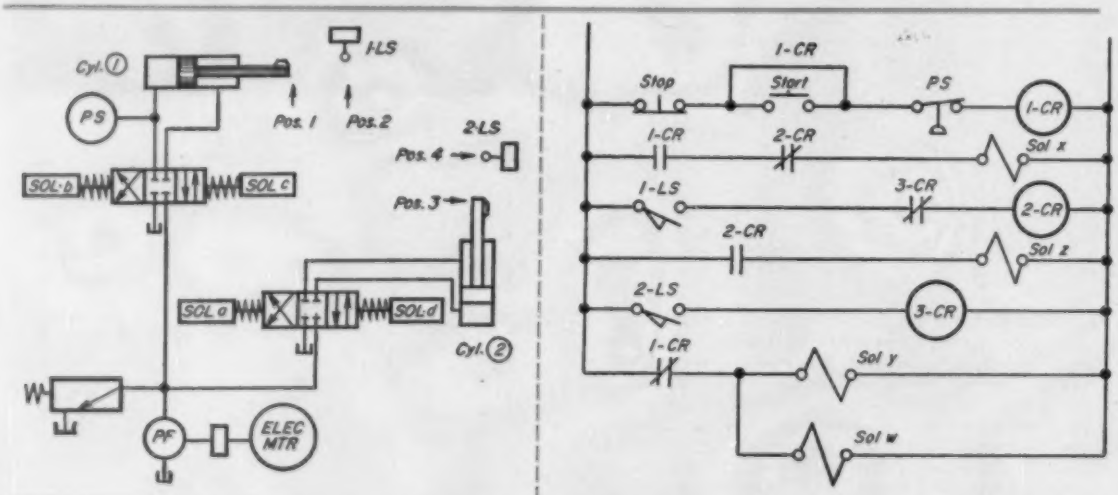


RECIPROCATION—Two limit switches provide automatic reciprocation when either the RIGHT or LEFT pushbutton switch is depressed. The cam moves with the cylinder motion and actuates the limit switches at either end of its travel. The limit switches are double-pole units with one normally open and one normally closed contact. Pushing the LEFT switch energizes solenoid (a) and relay 1-CR to move the cylinder and cam to the left. At the end of travel, limit switch 1-LS is actuated, de-energizing solenoid (a) and energizing solenoid (b) and relay 2-CR. Each relay locks in when it is actuated so that it remains energized preventing actuation of the alternate solenoid. This prevents both solenoids from being energized at the same time, should the pushbutton switch be accidentally pressed. Pressing the STOP switch de-energizes the system at any point, except the extreme positions.





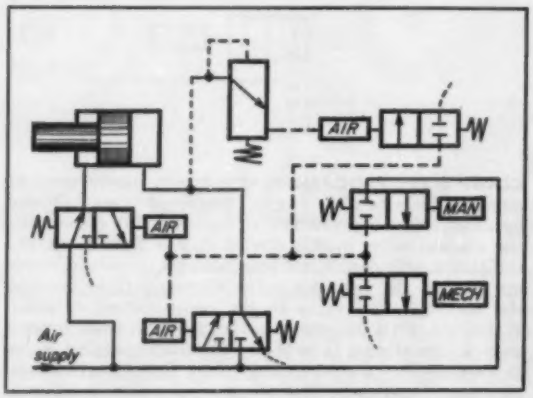
ACTUATING TWO RELAYS—The circuits show four methods to actuate two relays which energize solenoids of a valve controlling cylinder motion. In (a) the double-throw pushbutton switches are connected in the actuating circuits of the opposite relay to prevent both relays from being actuated at once. In circuit (b) wiring to the pushbutton station is reduced, but it is necessary to actuate the STOP switch before the FORWARD or REVERSE switch. Simultaneous actuation of both pushbuttons will not energize both relays if one picks up slightly before the other. In the operation of circuit (c) the FORWARD and REVERSE switches open contacts in the holding circuit of the opposite relay de-energizing that relay. However actuation of both switches at the same time will energize both relays. Circuit (d) uses a 3-position selector switch, and only one START switch is required. If a 2-position selector switch were used, it would have to be the break-before-make type. Use of a single pushbutton switch for energizing either relay may be a safety hazard.



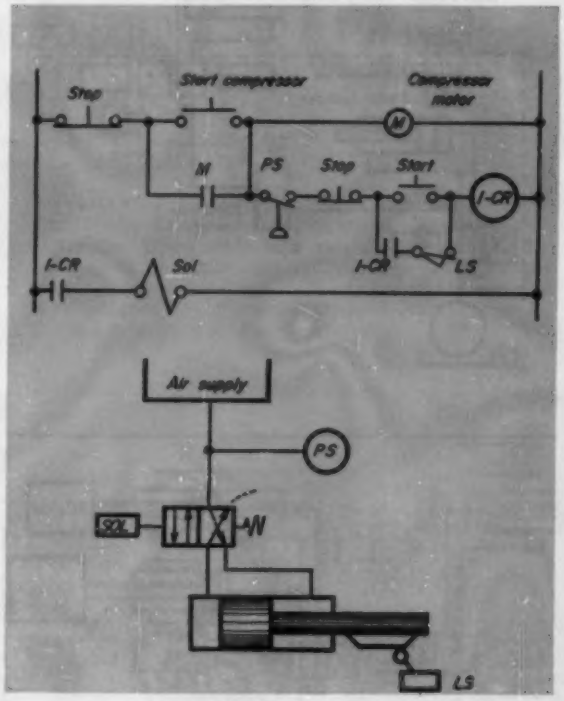
SEQUENCING—Cylinder 1 is required to advance and dwell while cylinder 2 rises to position 4. Both cylinders then retract together. Pushing the START switch energizes relay 1-CR and solenoid (b) advancing cylinder 1. Limit switch 1-LS is then actuated to energize relay 2-CR and solenoid (d) to extend cylinder 2 and de-energize solenoid (b) to stop cylinder 1. When limit switch 2-LS is actuated, relay 3-CR is energized to open the circuit to relay 2-CR and de-energize solenoid (d). Solenoid (b) is now energized so that pressure builds up on cylinder 1 until the pressure switch opens de-energizing relay 1-CR and energizing solenoids (c) and (a) to retract both cylinders to their original starting positions.

SAFETY CIRCUITS

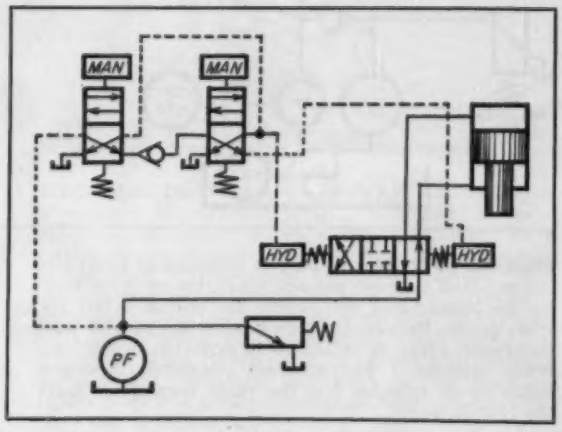
Safety of personnel and equipment should be a primary consideration in the design of fluid power equipment. These circuits prevent accidental operation, protect against overloads, and insure safe operation.



OVERLOAD PROTECTION—Connecting a sequence valve and auxiliary 2-way, pilot-operated valve in the circuit protects against over-pressures caused by overloads. The manual valve is operated to actuate the air pilot valves connected in the cylinder lines. If the extending cylinder meets an obstruction causing pressure in the head-end line to rise, the sequence valve will open to actuate the auxiliary 2-way valve. This exhausts the pilot line retracting the cylinder. Under normal operation, the cam-operated valve is actuated at the end of the cylinder stroke to exhaust the pilot line.



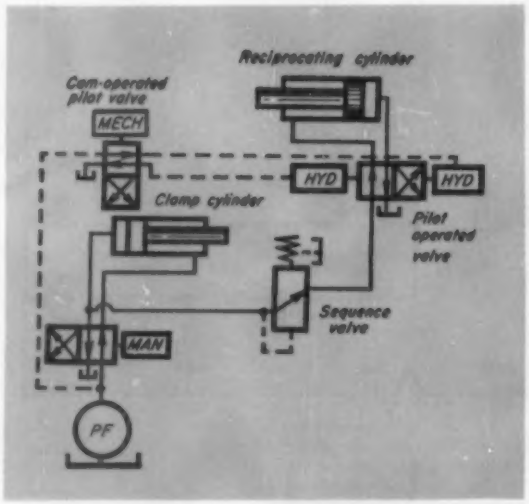
ELECTRICAL SAFETY CIRCUIT—Accidental operation is prevented by use of a pressure switch in this electrical circuit. The pressure switch closes when air is at the required pressure and permits energizing relay 1-CR with the START switch after the compressor motor relay has been actuated. The solenoid is actuated to extend the cylinder. At the end of the stroke, the limit switch is deactuated, de-energizing the solenoid valve and retracting the cylinder. The pressure switch prevents the solenoid valve from being energized when the air supply is off. If the solenoid valve were energized under this condition, when air pressure was restored, the machine would operate without being actuated, and would be a safety hazard.



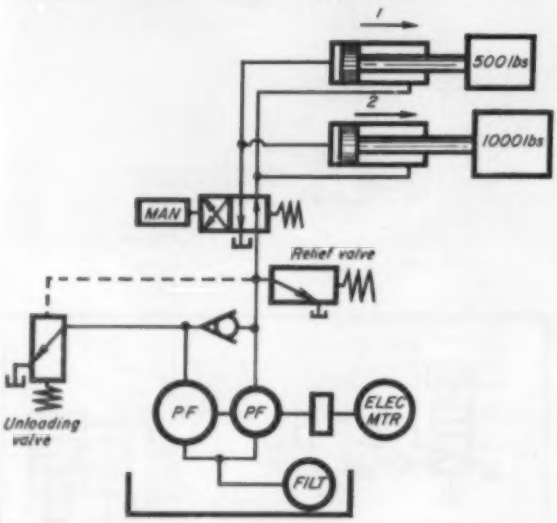
2-HAND OPERATION—On presses it is often important to have both the operator's hands engaged in pushing the controls to keep them out of the way of the descending ram. Both manual valves must be operated before the cylinder will extend. Releasing either valve while the cylinder is descending stops the cylinder. Both valves must be released before the cylinder retracts. Tying down one of the valves for "convenience" prevents raising the cylinder for a new cycle.

SEQUENCING CIRCUITS

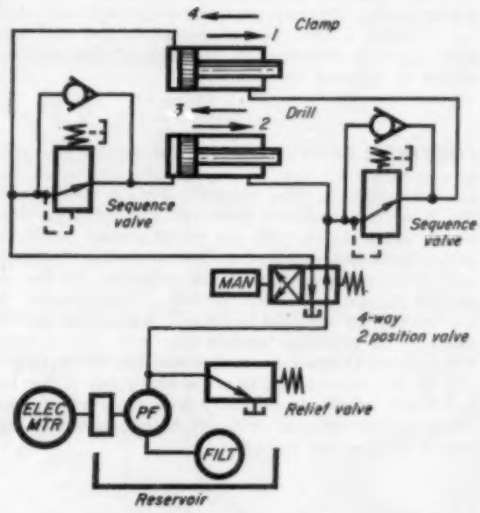
Several basic methods are available for sequencing fluid powered circuits. These are electrical, mechanical, and pressure operated control systems. In some automatic sequencing systems these methods are combined.



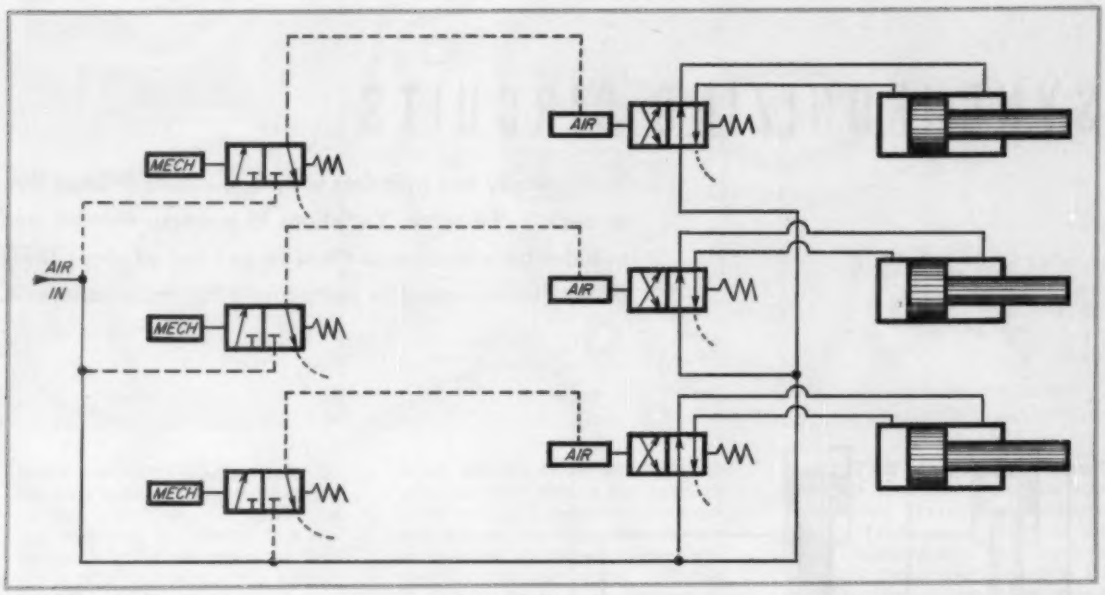
CLAMP & RECIPROCATION—A common requirement of machine tools is clamping of the work piece followed by automatic reciprocation of the work table. Shifting the manual valve in this circuit directs fluid to extend the clamp cylinder. When this bottoms, pressure builds up to open the sequence valve directing fluid through the pilot-operated valve to the reciprocating cylinder. When the cylinder reaches the forward and reverse ends of its stroke, it actuates the cam-operated valve to reverse the pilot-operated valve. Reciprocation continues automatically until the manual valve is reversed to release the clamp and remove pressure from the reciprocating cylinder.



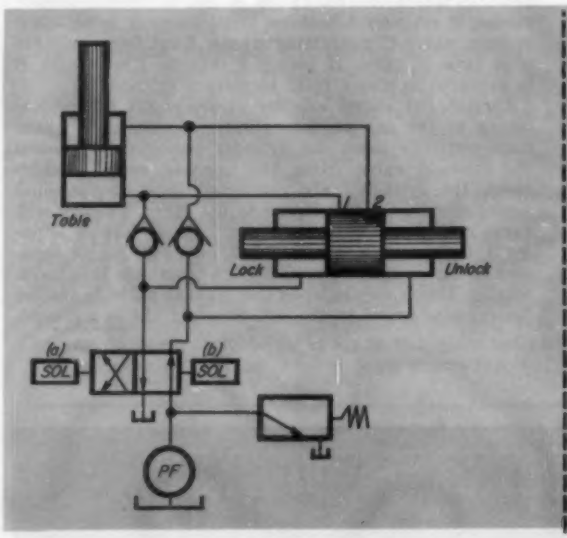
UNEQUAL LOADING—When two cylinders of equal size are required to move unequal loads, the cylinder moving the lighter load will extend and bottom before the other moves. Because fluid flow takes the path of least resistance, pressure builds up to move the 500-lb load. When cylinder 1 has extended completely, pressure builds up on cylinder 2 to the value required to move the 1000-lb load.



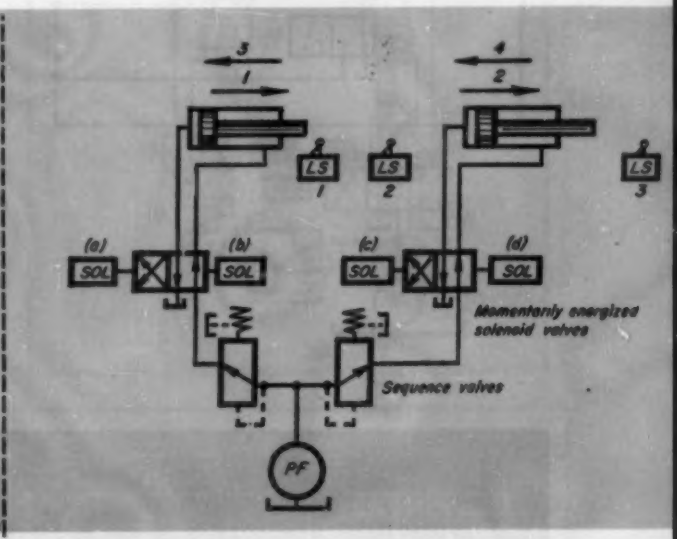
SEQUENCE VALVES—Several cylinders can be connected to move in sequence on the forward and return strokes. In this circuit, the clamp must close before the drill descends. On the return stroke, the drill must pull out of the work before the clamp opens. The sequence valves are arranged so that as pressure builds up when one cylinder completes its stroke, the valve opens to allow flow to the other cylinder.



CAM SHAFT—Flexibility in sequencing can often be achieved by using a cam shaft to actuate cam-operated valves. Length of actuation as well as sequencing is then a function of cam shape and the speed of the cam shaft. In this circuit, shop air is supplied to three cam-operated 3-way valves which are actuated by the cam shaft. In the spring-loaded position, these valves exhaust air from the pilot sections of three corresponding 4-way, air-operated valves which control the three cylinders. When the 3-way valves are actuated, they connect air pressure to shift the 4-way valves connecting air to the head end of the cylinders. If the cams are designed to be readily changed, this circuit can permit a quick machine change-over.



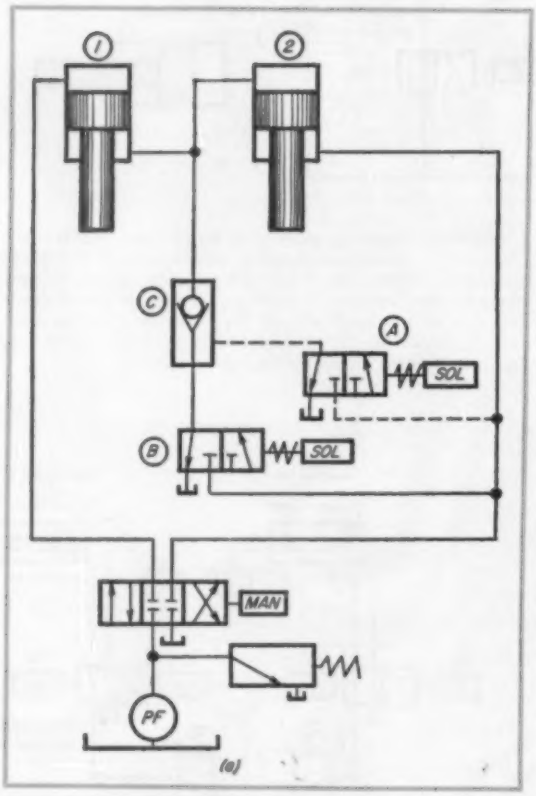
PORTED CYLINDER—Operation of the lock cylinder on this index table circuit sequences the table cylinder which raises the table for rotation. At the end of indexing the locking cylinder is shifted to the left and the table lowers. Solenoid (a) is energized to shift the lock cylinder to the right. This opens port 1 connecting fluid to raise the table cylinder. On the return stroke, port 2 is opened when the lock cylinder has shifted to the left directing fluid to lower the table cylinder. The check valves prevent fluid from flowing directly to the table cylinder without being sequenced through the lock cylinder.



ELECTRICAL CONTROL—Limit switches momentarily actuated by the cylinders control the solenoid valves to sequence this circuit. Solenoid (a) is energized by a pushbutton to initiate movement 1. At the completion of movement 1, limit switch 2-LS is actuated to energize solenoid (c) initiating movement 2. At the end of movement 2, limit switch 3-LS is actuated to energize solenoid (b) initiating movement 3. At the end of this movement, limit switch 1-LS is actuated to energize solenoid (d) initiating movement 4. The sequence valves prevent a pressure drop in either cylinder while the other operates.

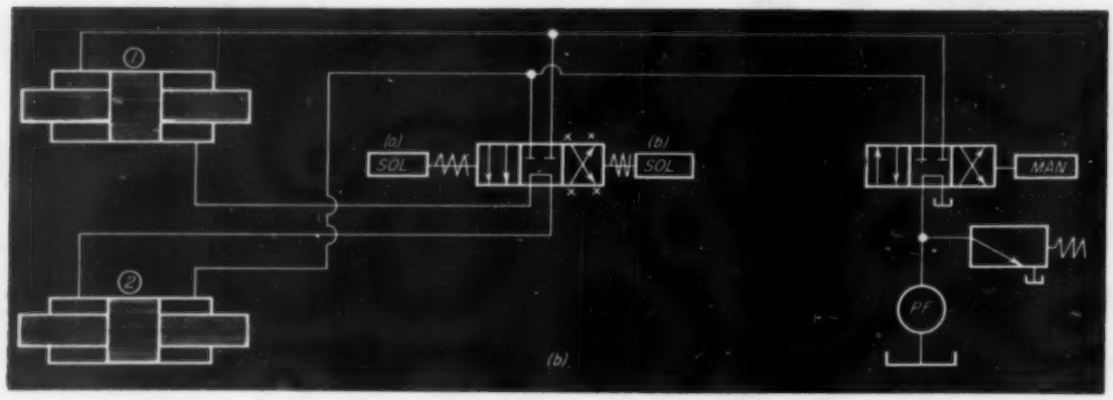
SYNCHRONIZING CIRCUITS

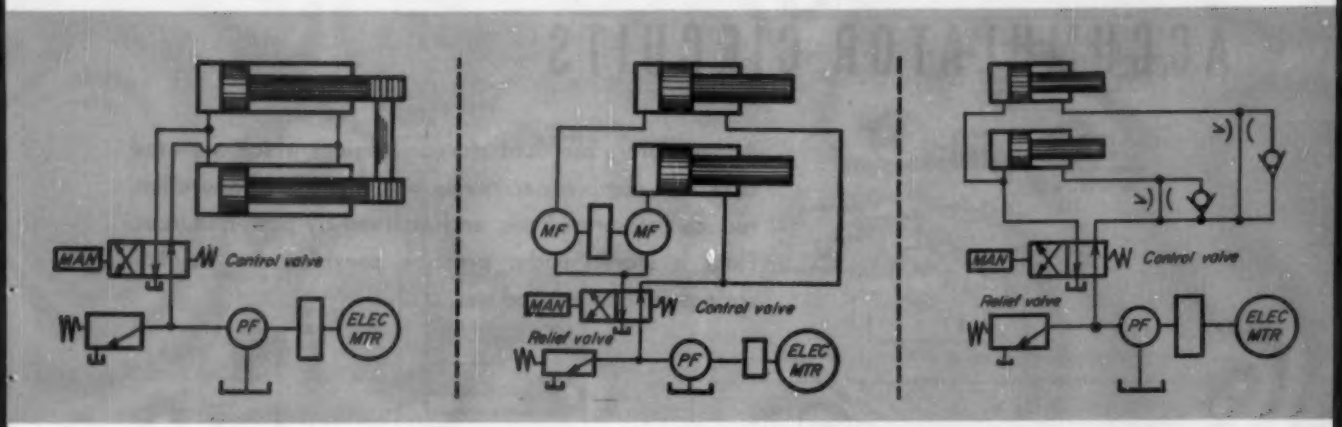
Theoretically two cylinders will move together when flow to each is the same. Variations in leakage, friction, and cylinder bore size cause them to get out of step. These circuits are designed to compensate for these variations.



REPLENISHING—One of the factors in synchronizing cylinders is to replace leakage. Under normal pressure, leakage can be practically zero over one stroke. Accumulative error is the main concern. A replenishing circuit which replaces leakage after each cylinder stroke eliminates this factor. In circuit (a) the cylinders are connected in series and controlled by the 4-way manual valve. The cylinders actuate limit switches which control valves *A* and *B*. On the return stroke, if cylinder 1 bottoms first, valve *A* is actuated to open valve *C* permitting excess fluid from cylinder 2 to flow to tank. If piston 2 returns first, valve *B* is actuated to direct fluid to retract cylinder 1.

Circuit (b) shows another arrangement for replenishing at the end of the cylinder stroke. Here again limit switches sense the cylinder positions to control the solenoid valve. With the solenoid valve de-energized, the cylinders are connected in a conventional series circuit. On the stroke to the right, leakage will cause cylinder 2 to lag cylinder 1. Therefore if cylinder 1 bottoms before cylinder 2, solenoid (a) is actuated to direct fluid to cylinder 2 to complete its stroke. Similar action occurs when the manual valve is shifted for cylinder travel to the left. Solenoid (b) is not used.



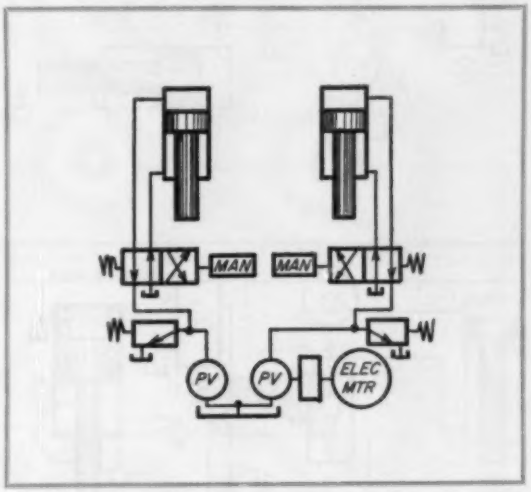


RACK & PINION—Mechanically tying two cylinders together by installing a rack on each piston rod and fastening the pinions to a single shaft works well when the linkage is rigid and the mesh is proper. A cable and pulley arrangement can also be used in place of the racks and pinions.

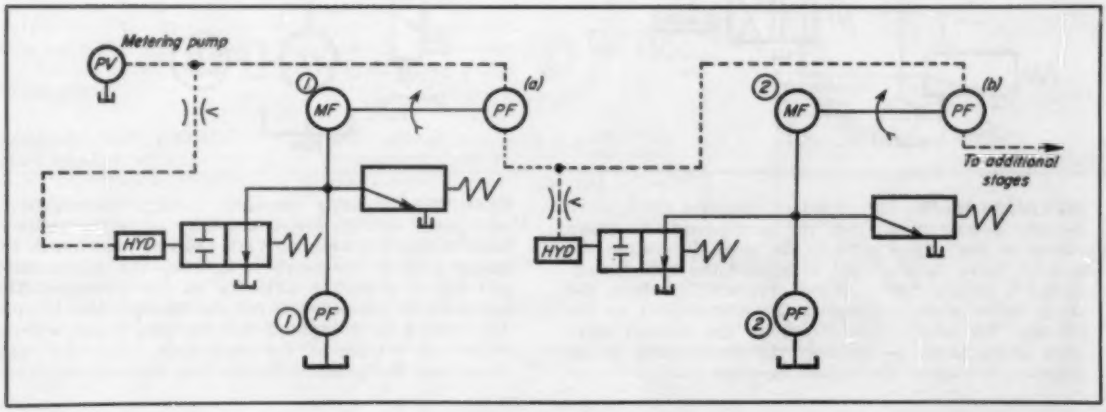
FLUID MOTOR FLOW DIVIDER—An effective flow divider can be made up of two fluid motors of the same size coupled together. Both motors must rotate at the same speed and therefore deliver equal volumes. Variations in load or friction do not greatly affect synchronization. Motor slip is a factor.

METERING—Independent adjustment of the meter-out flow control valves synchronizes cylinder motion. Leakage and friction will cause inaccuracies. Contaminated fluid can cause malfunction of the flow control valves. The valves should be pressure compensated if the loads are unequal.

TWO PUMPS—Under certain conditions two variable volume pumps can be used to move cylinders in unison. Leakage and slip are compensated by adjusting the strokes of the pumps. This circuit readily permits changing cylinder speeds as well as synchronizing their movement.

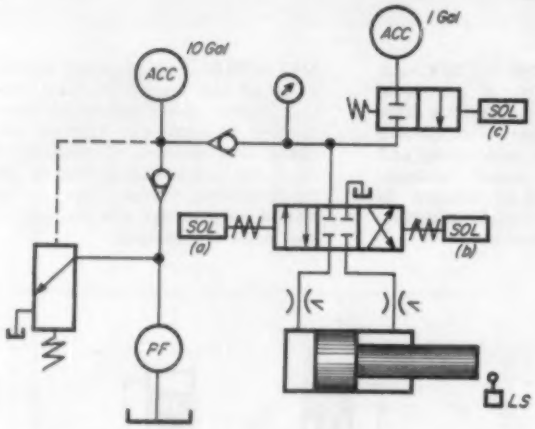


FLUID MOTOR CONTROL—Synchronizing fluid motor speeds is an important problem where the motors are driving rollers in a web process. Fluid to each motor is supplied by a separate pump and is controlled by a throttling valve which is shifted hydraulically between full-open and full-closed position. The metering pump is started first, shifting the metering valve for pump 1 to the closed position. Pump 1 and pump 2 are then started in turn delivering to motors 1 and 2 which drive auxiliary pumps (a) and (b). Flow through the metering pump and auxiliary pumps must be equal or pressure builds up on one of the metering valves. Thus if motor 1 slows down, pressure builds up on metering valve 1 and closes off the fluid bled from pump 1. This speeds up motor 1 to bring it up to the speed set on the metering pump. The orifices prevent hunting.

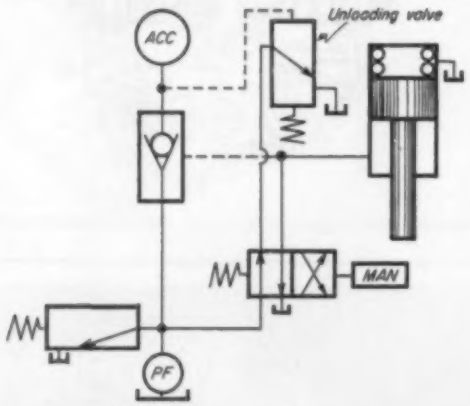


ACCUMULATOR CIRCUITS

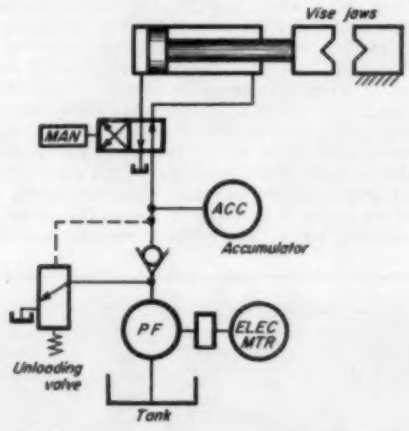
Accumulators are fluid storage devices which are used to reduce pump capacity requirements, speed operation, reduce pressure surges, and as stand-by power sources. Fluid is stored under pressure provided by weights, springs, or compressed gas.



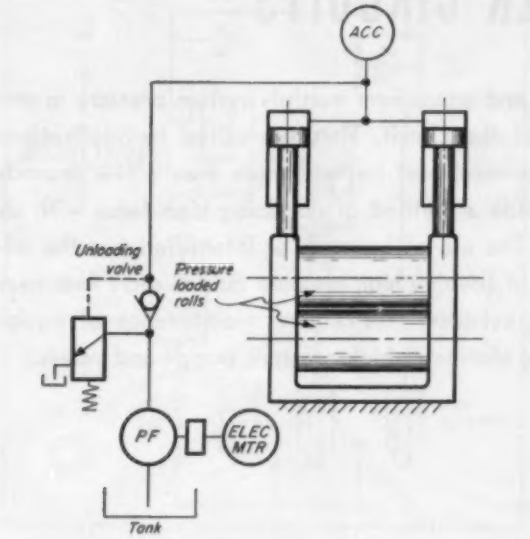
TRAVERSE & CLAMP—This arrangement of a large and small accumulator acts similar to a hi-lo circuit for rapid traverse and clamp. Fluid from the large accumulator combines with pump output to extend the cylinder rapidly. When the cylinder is fully extended, the limit switch is tripped to actuate solenoid (c). The small accumulator then maintains high clamping pressure on the cylinder for a timed period during which the pump recharges the large accumulator. Any fluid lost by the small accumulator will also be replaced during this time.



INCREASED SPEED—Use of a pilot-operated check valve permits adding fluid from the accumulator to pump output at the proper time in the cycle. Operating the manual valve directs fluid to retract the cylinder exerting a pulling force. When pressure increases, the check valve opens connecting the accumulator to the cylinder for fast action. Releasing the manual valve permits the pump to recharge the accumulator to the pressure setting of the unloading valve.



CLAMPING—Holding pressure, leakage compensation, and power savings are obtained by using the accumulator in this vise circuit. While the vise jaws are in the clamp position, pressure is held by the accumulator and pump output is unloaded at low pressure. The accumulator compensates for any leakage past the piston seals in the cylinder. When clamping pressure drops below the setting of the unloading valve, the valve closes and the pump recharges the accumulator.

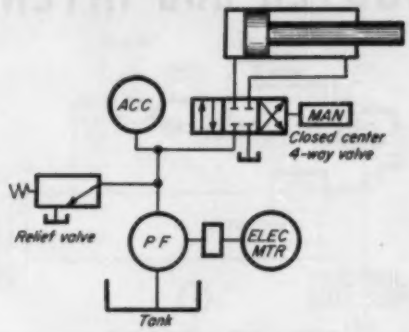


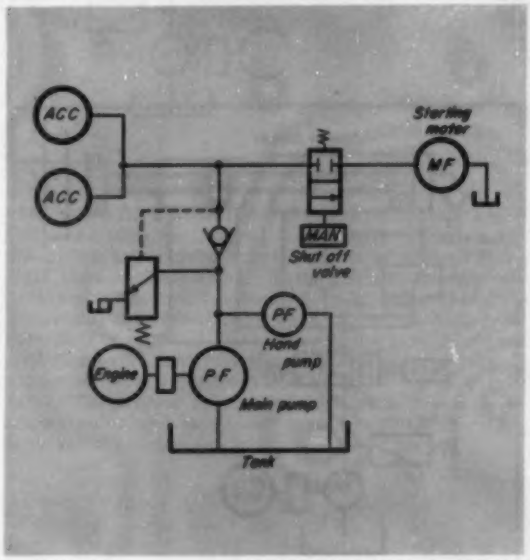
SAFETY DEVICE—These mill rolls are loaded by hydraulic pressure. Using an accumulator permits unloading the pump most of the time effecting a power savings. The accumulator also protects the rolls from damage if a large piece of foreign matter enters the mill. The accumulator absorbs the fluid which is displaced when the roll rises, and returns the fluid when the foreign matter has passed through.

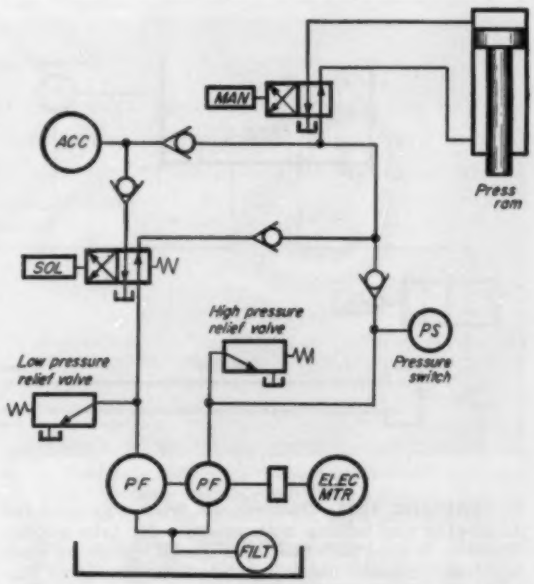
SURGE REDUCTION—Operating the 4-way closed-center valve in this circuit can cause the formation of shock pressures several times the value of the maximum pressure setting on the relief valve. Because the relief valve cannot act fast enough to drain off fluid, the high pressures can be dangerous to personnel and equipment. The accumulator in this circuit absorbs the surge pressures generated when the valve is placed in the neutral position.

STANDBY POWER SOURCE—In this diesel engine starting circuit maximum power is required only for a short period, and time between operations is long. Power for starting the engine is stored in the accumulators. During operation of the engine, the main pump charges the accumulators to the pressure setting of the unloading valve. The pump is then unloaded for the remainder of engine running time. For starting, the manual valve is opened connecting the combined output from the accumulators to drive the fluid motor. The hand pump is an emergency measure to recharge the accumulators in case of leakage over a long period of inactivity.

REDUCED PUMP CAPACITY—Frequently pumps can be sized smaller with the use of an accumulator. The accumulator volume adds to that of both pumps to speed down-travel of the press ram. When the ram meets sufficient resistance, the pressure switch is actuated shifting the solenoid valve. This directs fluid from the large pump to recharge the accumulator while the small pump continues to supply high pressure fluid to the ram. When the manually operated, 4-way valve is shifted for the return stroke, pressure is relieved, the solenoid valve is de-energized, and both pumps and the accumulator deliver fluid for rapid return.

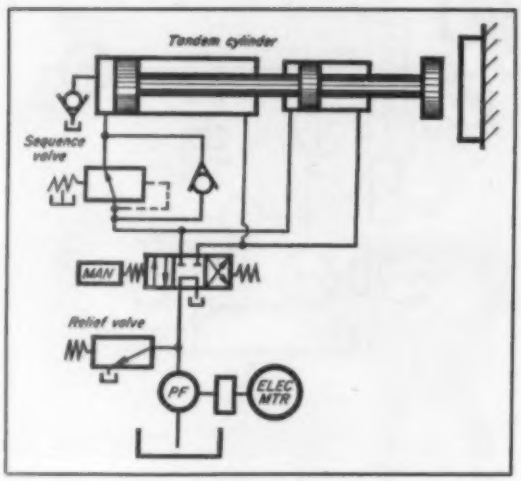




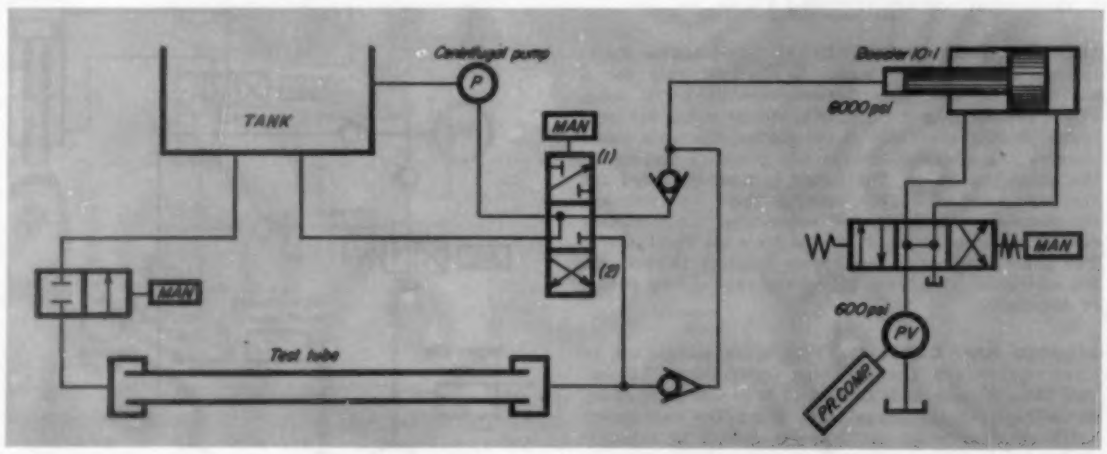


BOOSTER and INTENSIFIER CIRCUITS

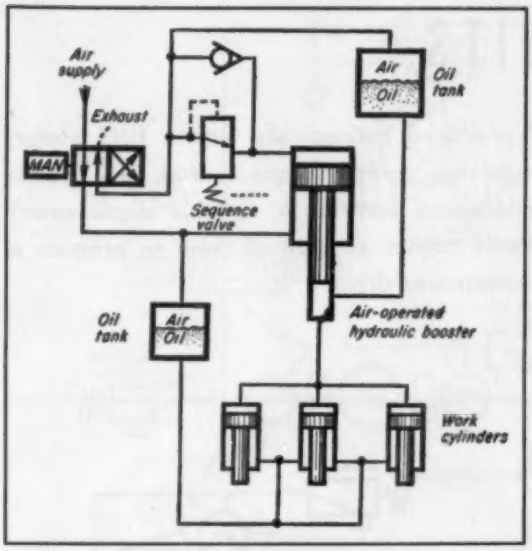
Boosters and intensifiers multiply system pressure in one section of the circuit. They are suited to applications where pressure must be held more than a few seconds and provide a method of obtaining high force with air systems. The use of boosters or intensifiers has the advantage of keeping high pressure fluid in short lines near the work cylinder. This reduces maintenance of equipment and eliminates high-pressure pumps and valves.

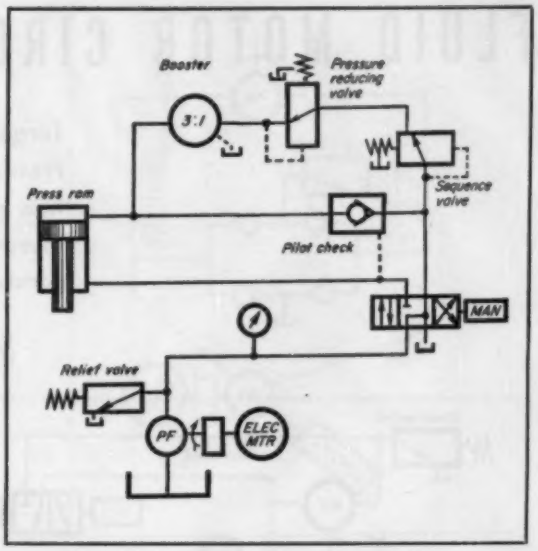


FORCE MULTIPLICATION—The two sections of this tandem cylinder are connected in parallel to provide fast approach to the work and high clamping force without use of high pressure. Shifting the 4-way valve directs fluid to the small cylinder for rapid closing. When the work is contacted, pressure builds up to open the sequence valve and apply pressure to the large cylinder. Clamping force is equal to the pressure of the relief valve setting times the combined areas of both cylinders. A replenishing line to the blank end of the large cylinder prevents pulling air in behind this cylinder during rapid advance. This circuit permits using a smaller capacity pump than would be needed in a circuit using a large cylinder operating at the same speed.



HYDROSTATIC TEST—Boosters are frequently used for developing and holding high pressure for tube testing. The tube is filled with fluid by a centrifugal pump when the detent manual valve is in position (2). After filling, this valve is shifted to neutral, bypassing the centrifugal pump output. The spring-centered valve is shifted to apply pump output to the 10:1 booster. The pressure compensated pump shifts to near zero delivery at 600 psi producing 6000 psi on the test tube. After the test, the spring-centered valve is released removing pressure, and the detent valve is shifted to position (1) to replenish the oil section of the booster.





HYDRAULIC INTENSIFICATION—Normal shop air pressure can be multiplied by using an air-oil booster. When the manual valve is shifted, air pressure forces oil from the upper tank to extend the work cylinders. When the work cylinders contact the load, pressure rises, opening the sequence valve and applying pressure to the booster. The booster piston extends to cover the oil port and then develops high pressure for holding the cylinders. Because forces are equal on the air and oil ends of the booster, pressures are inversely proportional to the rod and piston areas. Retraction of the work cylinders is accomplished with low pressure oil.

RECIPROCATING BOOSTER—The booster in this application contains an integral 4-way valve to reciprocate the piston and supply larger volumes of high-pressure fluid than a single-acting booster. When the required pressure is reached, the booster stalls, but will resume reciprocation automatically when additional high-pressure fluid is required. In this circuit the ram is lowered with fluid directly from the pump. When the load is contacted, the pressure rises to open the sequence valve. The booster is supplied through a pressure reducing valve and multiplies pressure three times for high force squeeze.

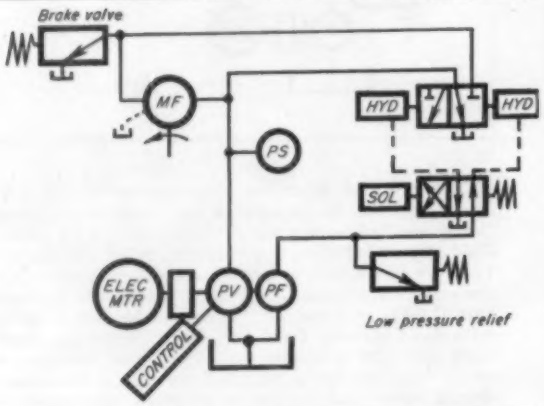
RESERVOIR DESIGN

Design of reservoirs depends on experience and the specific application. Here are 6 rules based on JIC Standards and recommendations of hydraulic equipment manufacturers.

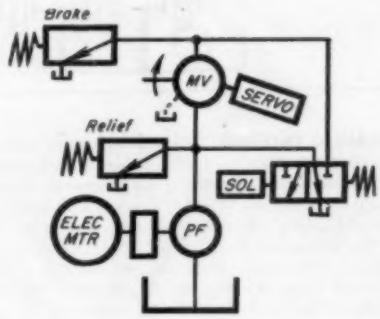
1. Capacity of the reservoir should be at least three times the volumetric rating of the pump. The limiting factor is heat dissipation, and the reservoir should be as large as possible within space limitations.
2. Some type of baffling should be included between the intake and return lines. Baffles direct the oil along a longer path and help settle out dirt, permit air bubbles to escape, and aid in cooling. In mobile equipment, baffles restrict sloshing of the fluid.
3. The reservoir should be readily accessible for cleaning. Sufficient access doors should be provided and should be gasketed to prevent entrance of foreign material.
4. A breather opening should be installed in the top surface of the reservoir. This should be capped by a cover of sufficient capacity to maintain approximate atmospheric pressure at maximum demands of the hydraulic system. All line connections should be made to the top of the tank.
5. A flush-mounted or protected fluid-level indicator should be installed near the filler opening. The indicator should be marked for high and low levels.
6. Sufficient space should be provided for a filter or strainer, and the intake line opening must be large enough to permit insertion and removal of the filter. A filter with more than twice the pump intake capacity should be used.

FLUID MOTOR CIRCUITS

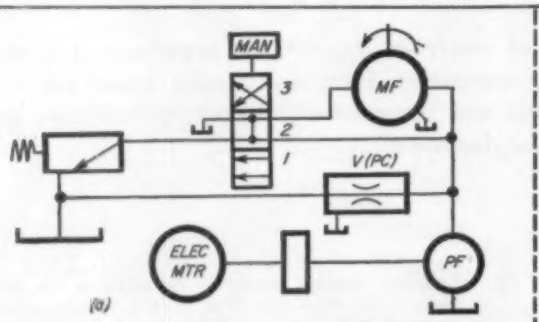
Torque is produced hydraulically with a fluid motor. Pressure regulation permits torque control. Flow regulation permits speed control. A variable displacement motor permits control of both of these to produce a constant horsepower drive.

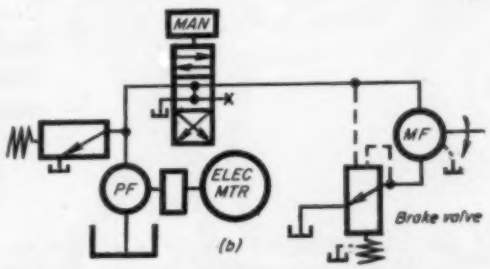


CONSTANT TORQUE—Driving a fixed displacement fluid motor at constant pressure produces a constant torque drive. Used with a variable volume pump to vary flow, the horsepower output of the motor varies with speed. If the load becomes excessive, pressure rises to actuate the pressure switch de-energizing the solenoid valve—pump unloads, fluid motor stops.

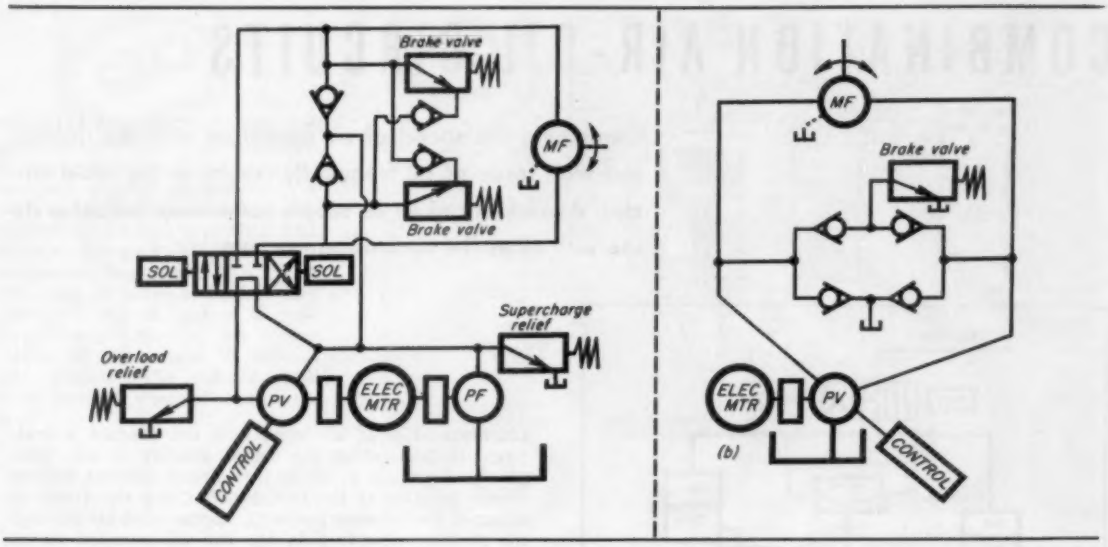


CONSTANT HORSEPOWER—A fixed displacement pump supplying a variable displacement fluid motor at constant pressure produces a constant horsepower drive. Minimum speed and maximum torque of the motor are produced when the displacement is maximum. Maximum speed and minimum torque are produced when the displacement is minimum.

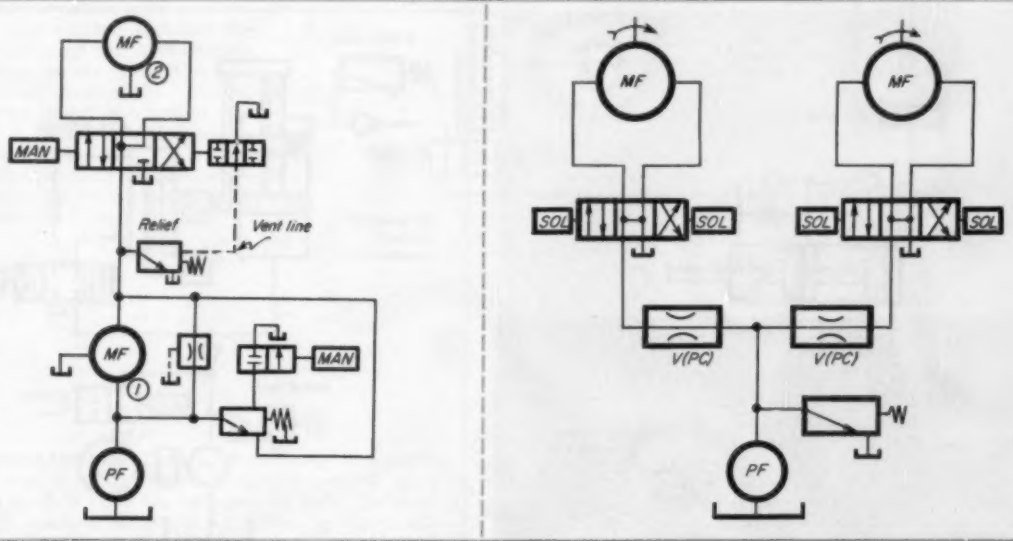




BRAKING—When pump delivery is cut off from a fluid motor, the motor continues to rotate because of its inertia and that of the connected load. The motor then acts as a pump and a source of fluid must be available to prevent it from sucking air. In (a) the 3-position manual valve provides for a coasting stop and braked stop, as well as the normal driving condition of the motor. With the valve in position 1, the pump output drives the fluid motor. In position 2, pump output and both sides of the fluid motor are connected to tank, so that the motor coasts to a stop. In position 3, the pump is unloaded and the motor, acting as a pump, forces fluid through the relief valve which brakes it to a stop. Circuit (b) shows a brake valve which is a modified sequence valve. It supplies braking force as well as control of a negative work load. Under normal driving conditions, system pressure holds the brake valve open for free discharge from the motor. A negative load reduces pressure at the motor inlet and the brake valve closes to throttle motor discharge and create a back pressure. To stop the motor, the 4-way valve is shifted to neutral.



REPLENISHING—When a fluid motor and pump are connected in a closed circuit, make-up fluid to compensate for leakage must be supplied through replenishing valves. These valves also supply fluid to the motor during braking. In circuit (a) a non-reversing variable volume pump is used and control of fluid motor direction is by the 4-way valve. The fixed displacement pump provides supercharge pressure. The network of check and relief valves provides for replenishing and braking in either direction. Braking pressure in each direction can be set independently on the two brake valves. In circuit (b) a reversing type pump is used. Although the replenishing network is simpler, brake pressure must be the same in both directions.

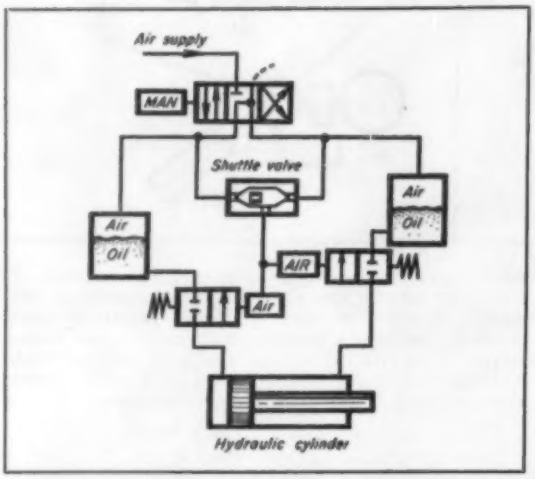


SERIES CONNECTION—Connecting two fluid motors in series minimizes pump size and eliminates a flow divider. Line sizes are also smaller than in a comparable parallel circuit, and piping is usually simpler, with only one pressure line and one return line required. Maximum torque at each motor is adjustable with the relief valves. The speed of motor 1 is controlled by the bleed-off flow control valve. Direction of motor 2 is controlled by the 4-way valve which has an integral 2-way valve which vents the relief valve when the motor is stopped. Total system pressure is then available at motor 1.

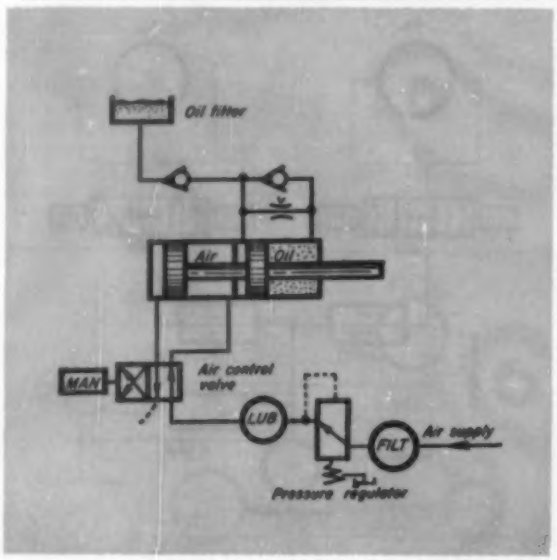
PARALLEL CONNECTION—Pump pressure can be lower in a parallel circuit because in a series circuit the pressure at the pump must be the sum of the pressure drops across the motors. However where motor pressures vary widely, there is a loss of efficiency in supplying the motors requiring lower pressures. This circuit is most efficient where the load on each motor is the same. Raising the pressure on one motor renders the others less efficient and may disrupt the speed relationship. In parallel circuits, the only way to increase torque of the highest pressure motor is to increase system pressure.

COMBINATION AIR-OIL CIRCUITS

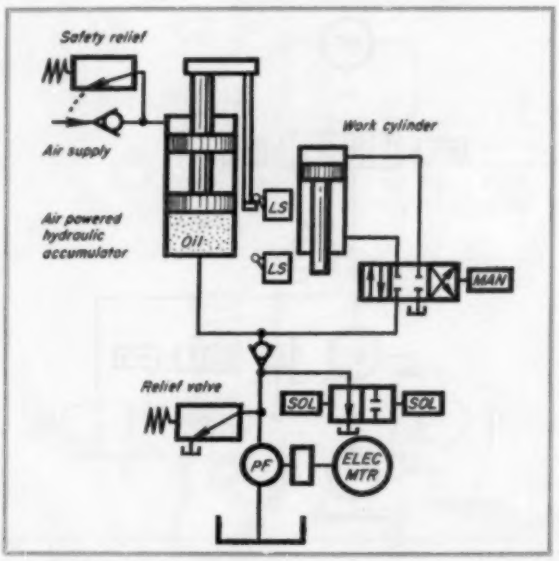
Combining the speed of air operation with the control and high force of oil frequently results in the ideal circuit. Availability of an air supply sometimes indicates its use with oil as the controlling medium.



LOCKING—Use of air alone does not produce a positive lock because of the compressibility of air. Converting from air to oil in this circuit permits locking in any position of the cylinder. Shifting the 4-way to either of the extreme positions, applies pilot air through the shuttle valve to hold the two air-operated valves open and apply oil under air pressure to the corresponding side of the cylinder. Positioning the manual valve to neutral exhausts pilot pressure closing the 2-way valves and trapping oil on both sides of the cylinder to lock it in position.

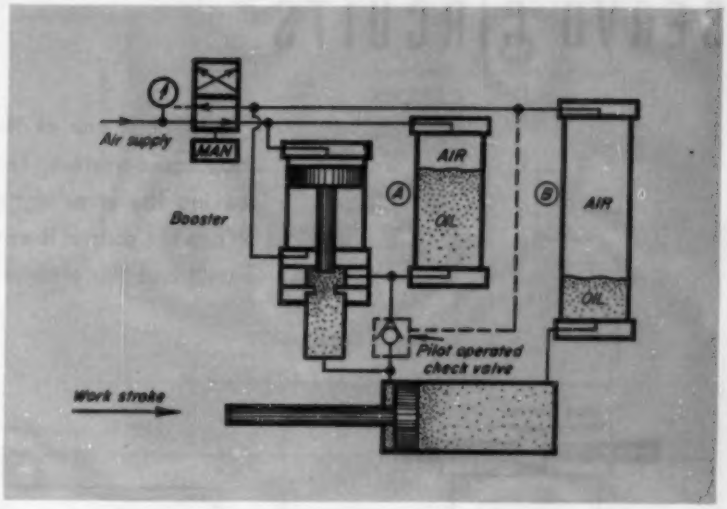


COMBINATION CYLINDER—Air actuation and oil control are combined in a single, 2-piston cylinder. Air controlled by the 4-way valve powers the cylinder in either direction. When the cylinder extends, oil is forced through the variable orifice which can be adjusted to control rate of feed. On the return stroke the orifice is bypassed by the check valve. The oil tank supplies make-up oil to compensate for leakage. Where force requirements can be met by air pressure, this circuit is satisfactory and costs less than a full hydraulic circuit.

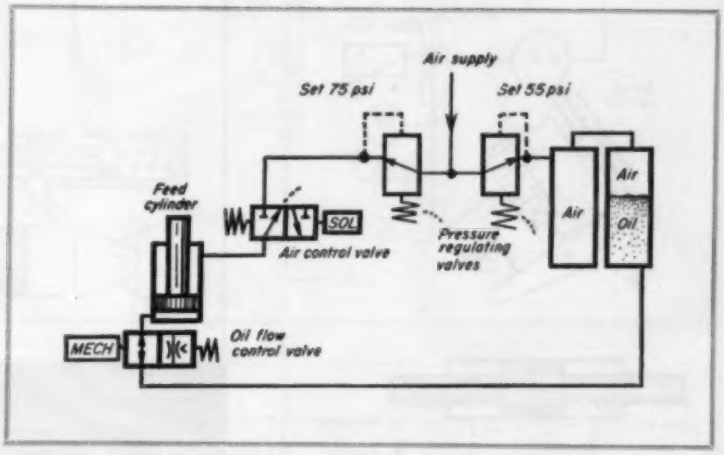


AIR-CHARGED ACCUMULATOR—Shop air is used to charge the accumulator in this circuit. Starting the pump directs oil to the accumulator. This raises the accumulator piston and compresses the air charge. At the top of the accumulator stroke, a limit switch is tripped to energize the solenoid unloading valve which dumps the pump volume. The accumulator then holds pressure on the work cylinder. As the accumulator piston drops because of leakage, a second limit switch is actuated to close the solenoid valve, so that the pump delivers fluid to the system.

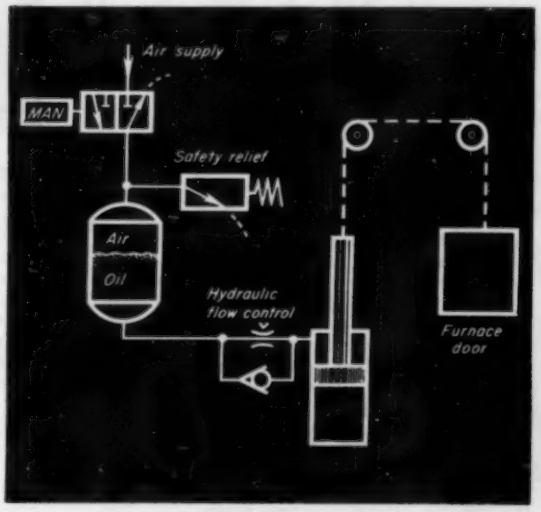
PRESSURE SEQUENCE—Initial high pressure followed by low pressure is the requirement in removing bushings and is accomplished by this circuit. Air pressure first acts against the booster to produce high force on the work. When the work resistance drops, air flow takes the path of least resistance and pushes oil out of tank *A* to complete the stroke. On the return stroke, oil from tank *B* extends the cylinder. The pilot-operated valve permits free oil return to tank *A*.



ADJUSTABLE SPEED CONTROL—Shop air is used as the main supply and charges the air tank at 55 psi. This air pressure is connected to the oil tank forcing oil through the cam-operated valve to extend the cylinder. The cam which actuates the valve can be contoured according to the speed sequence required. Operating the valve against the spring pressure opens it to provide fast movement of the cylinder. The spring-loaded position of the valve is a variable orifice which slows down the cylinder. Actuation of the solenoid-operated valve connects 75-psi air to the rod end of the cylinder to return it.

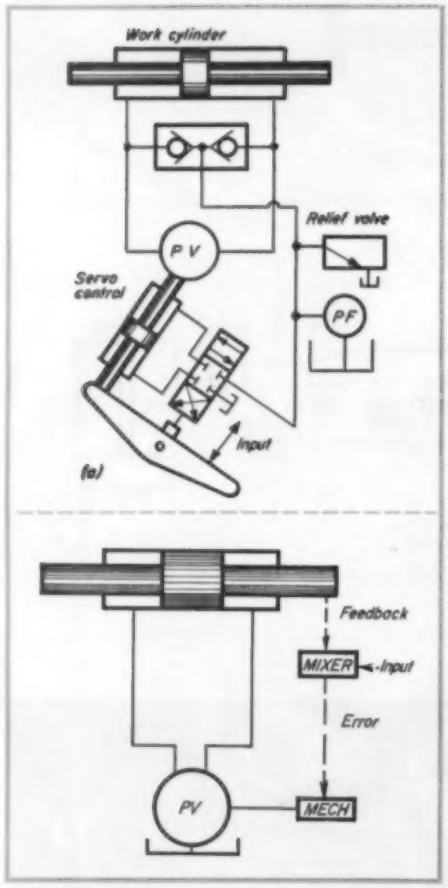


COUNTERBALANCING—Controlled lowering of a heavy furnace door is accomplished by a flow control valve metering oil flow from the cylinder. To raise the door, the 3-way, manual air valve is shifted to direct air pressure to the top of the air-oil tank. Oil at shop air pressure flows through the check valve to force the cylinder down and raise the door. The door is closed by releasing air pressure. The door pulls the cylinder up at a rate determined by the opening of the flow control valve. Many gravity lowered loads can be controlled with this circuit.

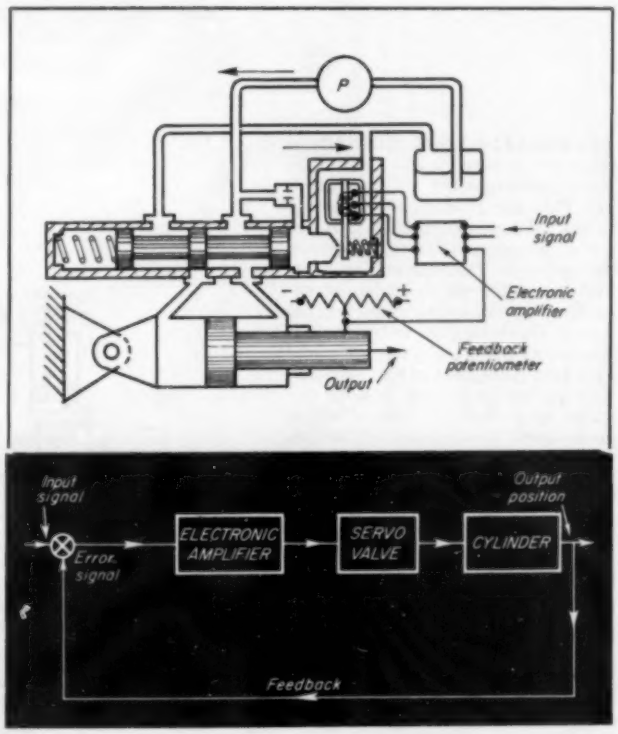


SERVO CIRCUITS

Feedback is one of the principal elements of a closed-loop servo system. This subtracts from the input signal leaving the error signal to actuate the output element. When the output is at the desired value feedback equals input, and the error is zero.

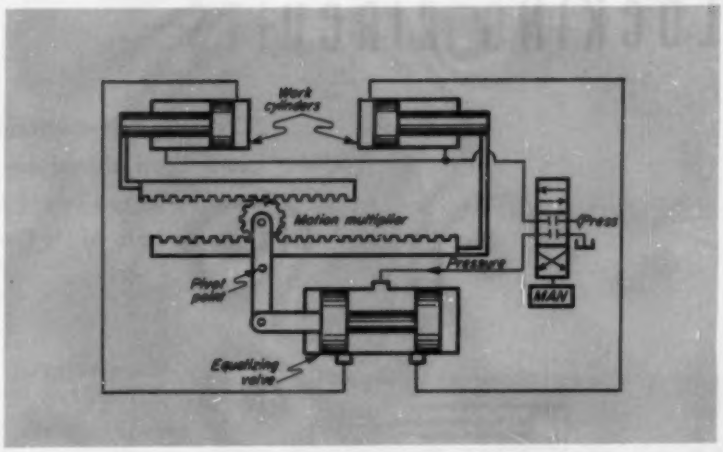


PUMP CONTROL—One method of controlling speed of a cylinder or fluid motor is by varying the displacement of a variable volume pump. In (a) the input is applied to a walking beam which shifts the 4-way valve to change pump displacement. When the pump reaches the required position, the valve is at neutral. The small fixed displacement pump is for supercharging, leakage make-up, and to power the servo control cylinder. A position servo is shown in (b). The position of the cylinder is fed back mechanically and combined with the input to produce an error signal controlling the variable volume pump.

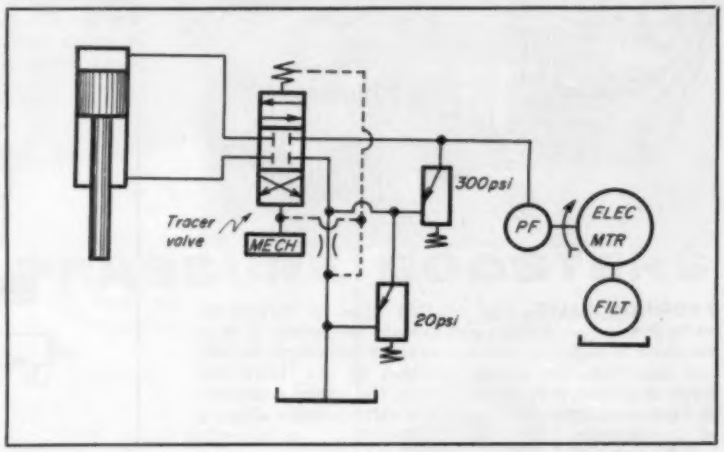


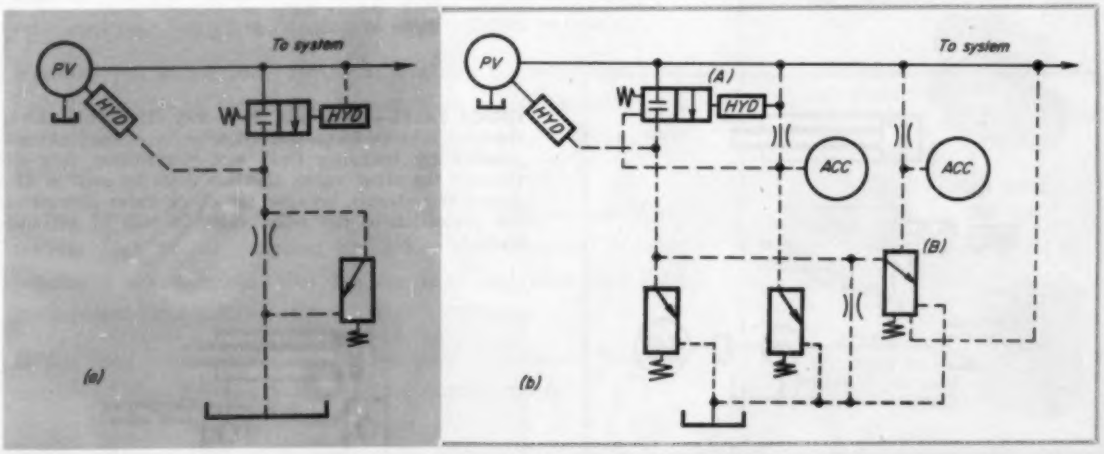
ELECTROHYDRAULIC SERVO—An electrohydraulic servo valve takes electrical input signals, converts these to hydraulic signals and then produces amplification. Electrical signals to the valve vary the position of a flapper covering a nozzle thus controlling fluid flowing out through the nozzle and the pressure drop across the fixed orifice. This regulates the pressure on one end of the spool, positioning the spool. This in turn positions the cylinder. A feedback potentiometer senses the position of the cylinder and feeds back an electrical signal to combine with the input signal producing the amplifier input or error signal.

SYNCHRONIZED CYLINDERS—Two movable racks and a pinion linked to the equalizing valve maintain synchronized motion of the two cylinders. If one cylinder starts to move faster or slower than the other, the pinion will move in a direction to position the valve so that more or less fluid is directed to the cylinders as required to synchronize their position. The 4-way valve permits stopping the cylinders at any point and reversing them.



TRACER CONTROL—The tracer valve has a stylus wheel which rides on a template the same contour as the finished work piece. The valve is mounted with the cutter head and is spring off-set to direct fluid to drive the cylinder down until the valve stylus contacts the work. The valve is then positioned to neutral position to stop the cylinder. The stylus wheel follows the template to direct fluid to the head or rod end of the cylinder positioning the tool accordingly. The 20-psi back pressure on the tracer valve stabilizes valve action. Exhaust oil rushing through the venturi-like orifice creates a suction to pull excess oil from the tracer valve. To minimize friction, no seals are used, and any leakage past the spool is pulled to tank by the simple vacuum system.

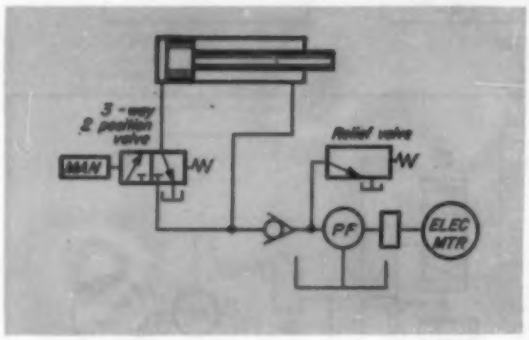




PRESSURE FEEDBACK—The variable volume pump is positioned by pressure fed back from the system. In (a) the 2-way valve is positioned between its full-open position and full-closed position by system pressure. The valve directs an amount of fluid through the orifice depending on system pressure. This produces a variable pressure at the orifice which is applied to the control cylinder of the pump. The relief valve limits the control pressure and absorbs excess flow during transients. A rate-compensated circuit is shown in (b). Valve *A* is compensated to accept surge input. Valve *B* allows the control orifice to be bypassed during a rapid decrease of system pressure giving a rapid increase in pump delivery. If the pressure begins to fall at a rate equal to or greater than the critical rate of valve *B*, stored energy in the accumulator opens the valve, and the pump pilot section is opened to tank, quickly increasing pump stroke.

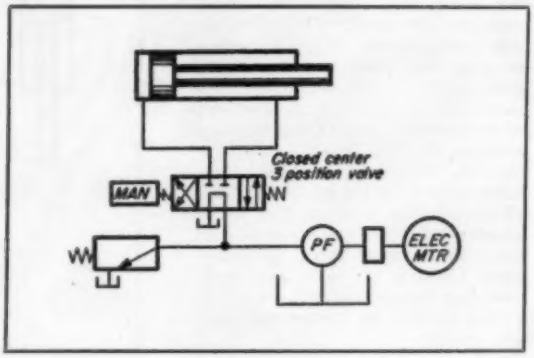
LOCKING CIRCUITS

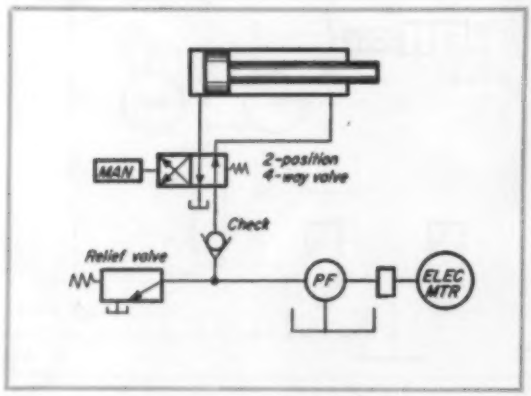
Cylinder movement caused by high loads or system pressure drop should be prevented. A hydraulic cylinder can be locked in any position of its travel by closing off one or both of its lines.



3-POSITION VALVE—Use of this type of directional valve locks the cylinder and unloads the pump. If it is required to lock the cylinder against movement in only one direction, the center position of the valve can have only one port blocked with the other connected to tank. Any leakage through the valve permits slipping of the cylinder.

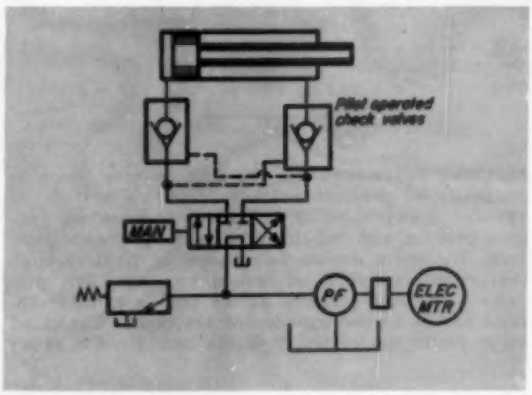
DIFFERENTIAL CYLINDERS—Although the cylinder can usually be held against its end stops with fluid pressure, the check valve is needed for positive locking. Without the check valve, an external load could overcome the locking force and move the cylinder by blowing fluid through the relief valve. In addition, a drop in pump pressure caused by operation of another cylinder would cause unlocking.

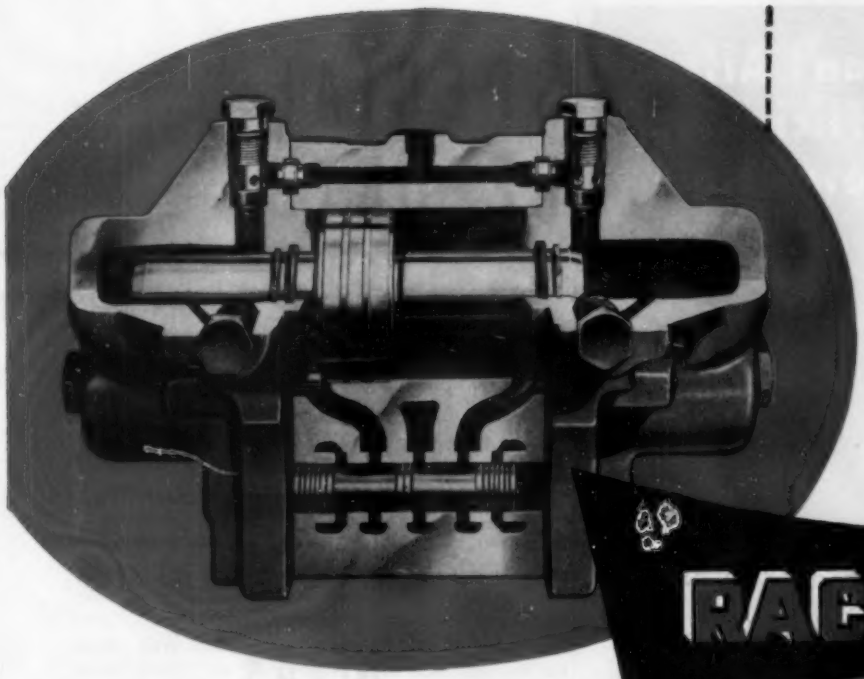




LEAKAGE PREVENTION—When a 3-position valve is used to lock a cylinder, pilot-operated check valves connected in the cylinder lines prevent leakage through the manual spool valve. In these poppet type valves the seal becomes tighter with increasing pressure. The check valves should have light enough springs to permit them to open and allow reverse flow at a pressure determined by the load and by cylinder resistance.

CHECK VALVE—Used with the 4-way directional valve, the check valve locks the cylinder in either extreme position by trapping fluid and preventing blow-off through the relief valve. Caution must be used in applying this circuit, because the check valve eliminates the protection of the relief valve in case of extreme loads.





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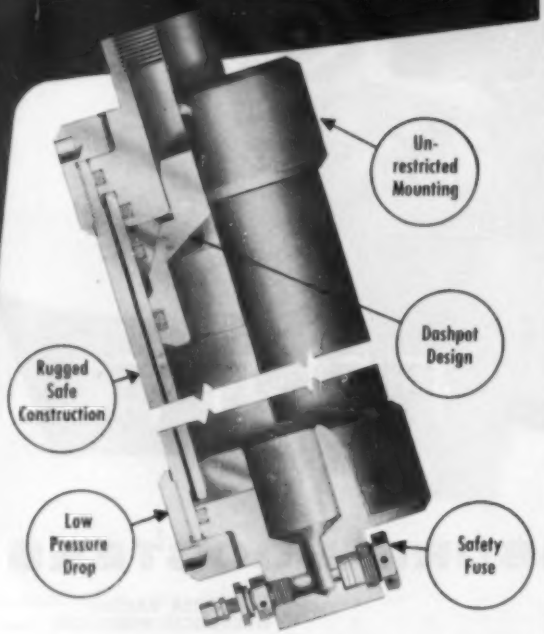

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SPECIAL REPORTS

On the following pag

What to do about port seals, and dimensional interchangeability, highlighted the Fluid Power Trade Association's meeting held in Cleveland in November.

NFPA's Fall Meeting

Business Session

• **Organizational Changes:** HPM's Dick Pittman, who heads the Rules Committee of the National Fluid Power Association, reported that a review of the Association's Constitution has resulted in several proposals which the membership will consider.

1. Would more flexibility of operation result if the country were divided into three regions with a regional vice-president elected in each?
2. With a regional set-up, would one annual meeting for the whole association, instead of the present two, be preferred? Frequency of regional meetings could be arranged to suit the needs of each region.
3. Should the Association have honorary members?

• **Membership:** Lynn Charlson reported the acceptance of three companies into the Association membership. Bringing total membership to 66, the new members are: Watts Regulator; Cessna Aircraft, Hydraulics Division; and Airmatic Valve.

• **New Chairmen:** Vice-Chairmen of committees of the Management Services Board were appointed by Board Chairman A. F. Jensen. They are: Roy R. Stevens, Westinghouse Air Brake, Government Relations Committee; J. E. Ellis, Jr., Hanna Engineering, Education Committee; G. R. Pittman, HPM, and George Carlson, Minnesota Rubber and Gasket, Public Relations Committee.

pages are detailed reports of three recent meetings

• **Fluid Power Industry:** Recognition by the Government of fluid power component manufacturers as an industry has been made in the establishment of a Department of Commerce Advisory Committee. David Fromsom, Greer Hydraulics, describing the formation of this committee indicated that it would be made up manufacturers of such items as pumps and motors, valves, accumulators, and actuators. Suggested items for discussion at the first meeting in November '56 were Government policy on manpower and materials in an emergency, and standards.

• **Education:** The NFPA has several projects underway in the area of fluid power education. A bibliography of books in the field has been completed. Method of reproduction and distribution is being studied. The education committee is developing a procedure to assist schools who are requesting information and equipment for fluid power courses.

Fitting Symposium

• **Leakage Control:** Committee on port seal developments presented a panel discussion. Four men represented users; three men represented manufacturers of fittings designed to solve this port seal problem. The users emphasized—leakage at ports is often excessive. George Quail of Yale & Towne said that most of their present hydraulic systems on industrial trucks are using Dryseal pipe threads. Where assembly is frequent—on test units

PORT SEAL developments were the subject of this panel. G. T. Lyon is at the rostrum. To his left are: John Rauen, Defense Department; Frank Mackin, G. M.; C. L. Kepner, Caterpillar; Paul Haar, Warner & Swasey. On Lyon's right are: Frank Flick, Flick-Reedy Corp.

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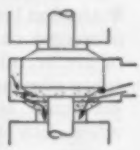
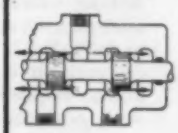


Poppets score



Spools leak

Write for Bulletin W-5.

BARKSDALE VALVES

5125 Alcoa Avenue, Los Angeles 58, California

NFPA's FALL MEETING

Continued

—they are using some of the Teflon inserted lock nuts (Tru-Seal) with success. Quail asked: "Why not a straight thread with a sealing nut?"

• **Low Pressure:** Paul Haar of Warner & Swasey, said their designs which are mostly in the 150 psi range use pipe threads with sealing compound. If leakage does occur, it is the result of an imperfect thread, insufficient torque or ineffective sealing compound.

• **Construction Equipment:** Vibration is the chief "leakage maker" on construction equipment, according to Caterpillar's C. L. Kepner. His company has been using O-ring flange joints for 10 years with good results. Pressures, now at 1500 psi, are heading upward. Critical factors at the port seal are:

a. O-ring groove dimensions
b. proper assembly—"Don't pinch the O-ring"
c. welded joint between tube and flange
d. thickness of flange and number of bolts
e. external loads

• **Automotive Plants:** Frank Mackin, GM, listed four major causes of leakage:

a. poor design
b. poor quality
c. poor installation
d. poor maintenance

He emphasized the need for research in control of vibration.

• **The Case For New Fittings:** Frank Flick, described his company's development of the "Tru-Seal"—a metal hexagon nut with pipe-threaded Teflon insert. Emphasizing the present wide use of pipe threads throughout the world, Flick said their efforts have been aimed toward a sealing device which would be interchangeable and compatible with units in the field. Field and lab reports on the use of this sealing nut are very satisfactory. Sizes range from 1/8 to 2-1/2-inches, and they withstand temperatures from -280 to 500 degrees F. Resistance to vibration is equivalent to a welded steel connection.

Flick announced that metal-to-metal seals similar to Tru-Seal for service up to 1200 degrees will soon be available.

• **Straight Thread Fittings:** The case for straight thread metal "CN" fittings was presented by L & L's president, G. T. Lyon. This fitting does not use an O-ring seal. In answer to a question from the floor, Lyon said that licensing arrangements for manufacture of this fitting by other companies is being arranged. Lyon reported that this metal-to-metal seal holds pressure to yield point of the material of either fitting or port; has excellent resistance to vibration; and can be asembled repeatedly without damage. Illustrating various

Continued on page 218

WEATHERHEAD

First in components for HYDRAULIC SYSTEMS

Look at anything . . . anywhere in the world . . . in hydraulics, diesel power or machine tool applications . . . equipment for instrumentation, oil drilling, mining, road building, petro-chemicals or even atomic power . . . chances are the vital air and fluid lifelines are secured with WEATHERHEAD.

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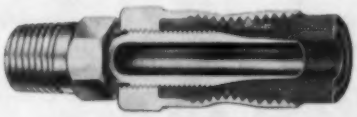
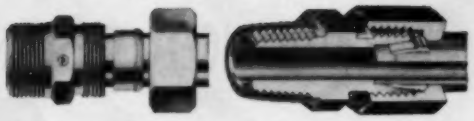


Bulk Hose

Hose Assemblies

Crimped | Swaged

ERMETO



SAE 37° FLARE

3-PIECE

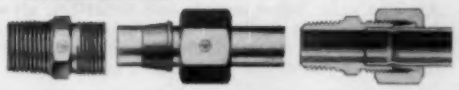
2-PIECE

SAE 45° FLARE

INVERTED FLARE

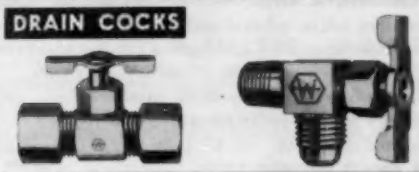
COMPRESSION

SELFALIGN



PIPE

DRAIN COCKS



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The only single-source hydraulic hose and fitting line.

Available coast-to-coast through Weatherhead distributors.

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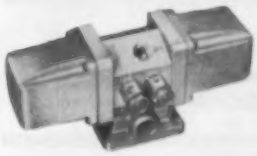
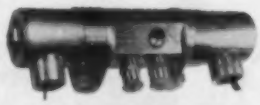
HI-CYCLIC

AIR and HYDRAULIC DIRECTIONAL CONTROL VALVES

A COMPLETE LINE—Solenoid, manifold, piloted, solenoid piloted, lever, cam roller, spring center, detent and combinations of these actuators are available for immediate delivery. All spool characteristics: 2 position, 3 position, float piston, open center, closed center, servo type, port exhausting center position—all carried in stock.

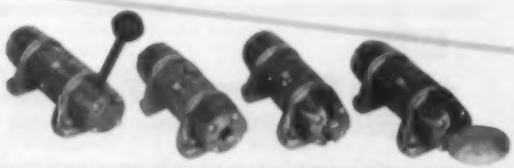


DIRECT SOLENOID-OPERATED VALVES
Available in ⅛" to ½" pipe ports. Built-in junction box; heavy-duty, industrial-type solenoids; moisture-tight covers.



SOLENOID VALVE-PILOTED MODELS
Fast operating — inexpensive. Available for practically every voltage, current, cycle and ambient condition. All sizes furnished for ⅛" to 1" pipe ports for air and gas service only.

MANIFOLD VALVES (GASKET MOUNTED)
All Hi-Cyclic Valve models—all actuators, all spool types—available with gasket-mounting for sub-base piping. Designed for absolute minimum down-time for parts replacement.



MECHANICAL AND HAND-OPERATED VALVES
Lever, cam roller, piloted and fingertip valves. All actuators interchangeable and valves can be equipped with combinations of these actuators—as a cam valve may be pilot returned; or hand-lever valve may be cam roller returned, etc. Furnished from ⅛" to 1" pipe ports except fingertip valve, which is available to ½" pipe ports only.

Write for complete valve catalog or detailed information on Hi-Cyclic Valves to meet your job requirements.

DISTRIBUTORS IN MAJOR CITIES COAST-TO-COAST

THE BECKETT-HARCUM COMPANY
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port designs, Lyon emphasized the wider machining tolerances and simplicity of the "CN" straight thread port.

• **SAE Straight Thread Fitting:** Successful application and wide acceptance of the SAE straight thread fitting using O-ring seal was emphasized by L. M. Schmohl of Parker Appliance. Drawing a comparison to the AND 10050 fitting, this design results in less stress. O-rings can be supplied to be compatible with all types of fluids used in hydraulic systems. Good resistance to vibration and pressure is reported. Extrusion of the O-ring under high pressure is avoided by the addition of a flat washer.

Component Standardization

• **Interchangeability of Components:** Standardization of mounting dimensions should start with cylinders. This was the general opinion of the panel of users discussing this subject. Representing ASTE, Philip Lindhuber of the Dana Corp. indicated some of the problems in specifying cylinders, such as the difficulty in determining mounting dimensions from sales literature and variations in nomenclature from one manufacturer to another. Standardization is needed for greater safety, easier maintenance, lower cost, and simpler procurement, he said.

• **How to standardize:** Outlining procedures of standardization in the electrical industry, Ed Rivoria, Cincinnati Milling Machine Co. stressed that standards must be flexible to permit technological improvements. Interchangeability helps both the machine user and the manufacturer, but the problem of standardization requires a complete understanding of everyone's interest. The broad objectives must be outlined before starting a program of standardization.

Reviewing the desirability of standardization, J. E. Merkle of Ford said that panel mounted components are among the most important for this program. One of the first jobs should be to establish uniform ratings.

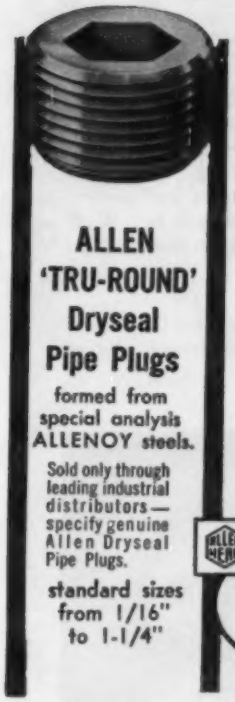
• **Fluid Interchangeability:** Change-over from non-fire resistant fluid to fire resistant fluid was commented on by Tom Smith, Celanese. The amount of work involved in this change-over can be an important factor in the selection of a fire resistant fluid.

• **Automotive Standards:** It is not the intent of standards set up by the automotive industry to limit cylinder design to the tie rod type and eliminate others. The standards pertain to overall envelope dimensions and other designs are acceptable within these dimensions.

Continued on page 220

Circle 9 on Reader Service Card

3000 psi won't get by the threads of Allen ○ Dryseals!



ALLEN 'TRU-ROUND' Dryseal Pipe Plugs

formed from special analysis ALLENOY steels.

Sold only through leading industrial distributors—specify genuine Allen Dryseal Pipe Plugs.

standard sizes from 1/16" to 1-1/4"

Here's the dependable, metal-to-metal seal you need for hydraulic systems . . . for transmission, control, and automated mechanisms where pressures run high. The N.P.T.F. threads of Allen ○ Dryseal Pipe Plugs are smooth, burnished, and burr-free — do their job without any help from sealing compounds. Allen's unique "pressur-forming" process assures the highest degree of precision threading and dimensional accuracy. What's more, Allen ○ Dryseals are precisely round at root, pitch and crest, with taper held to extremely close tolerances.

Allen engineers will gladly help you to harness your hydraulic pressures. Just write.

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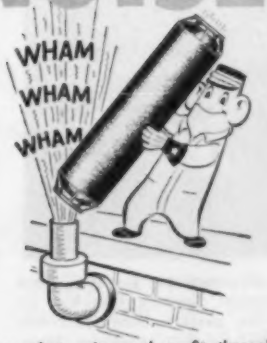
from Air, Steam and other gas discharges with BURGESS-MANNING SNUBBERS



Stop that noise and profit through better neighbor and employee relations. Avoid compensation claims.

Burgess-Manning Snubbers are engineered to effectively correct your specific noise problem.

Tell us your noise problem and let us recommend—no obligation

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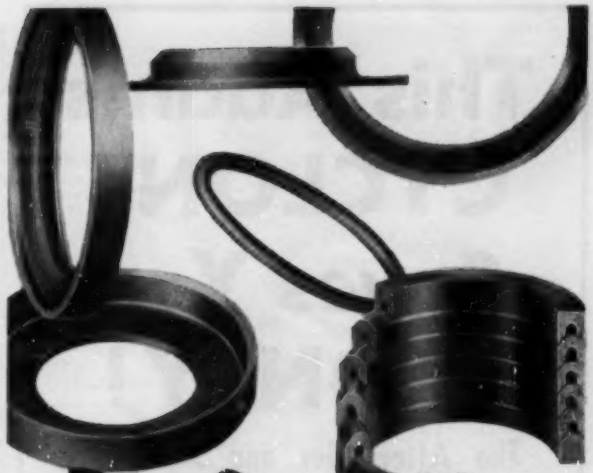

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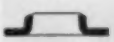
PALMETTO O-RING—A popular seal for low and medium pressures. Simplifies design—saves space. Also recommended for gasket applications.

PALMETTO KUP—A popular piston packing available in a variety of fabrications to seal the standard or new synthetic fluids. More resistant to heat than leather . . . will not dry out in air.



PALMETTO FLANGE—For rod packing in low pressure service. Adaptable to reciprocating or rotary motion. Also used as dust seal.

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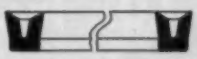

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The Aftercooler and Separator that assures

DRIER Compressed Air

Here's real teamwork! First, the Adams Aftercooler brings the compressed air temperature down — within 10 of the cooling water — where it holds almost 40% less moisture than air from conventional units.

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NFPA's FALL MEETING

Continued

Marketing Session

• **What's Marketing?** Too often marketing may seem to be a function created for the unemployed son-in-law. But in the buyer's market of today, marketing is a planned function and includes market research, product planning, advertising, selling, and marketing administration and control. How certain can marketing indications be? W. R. Lockridge, New York Air Brake stated that the essence of organized marketing is the intelligent assumption of risk.

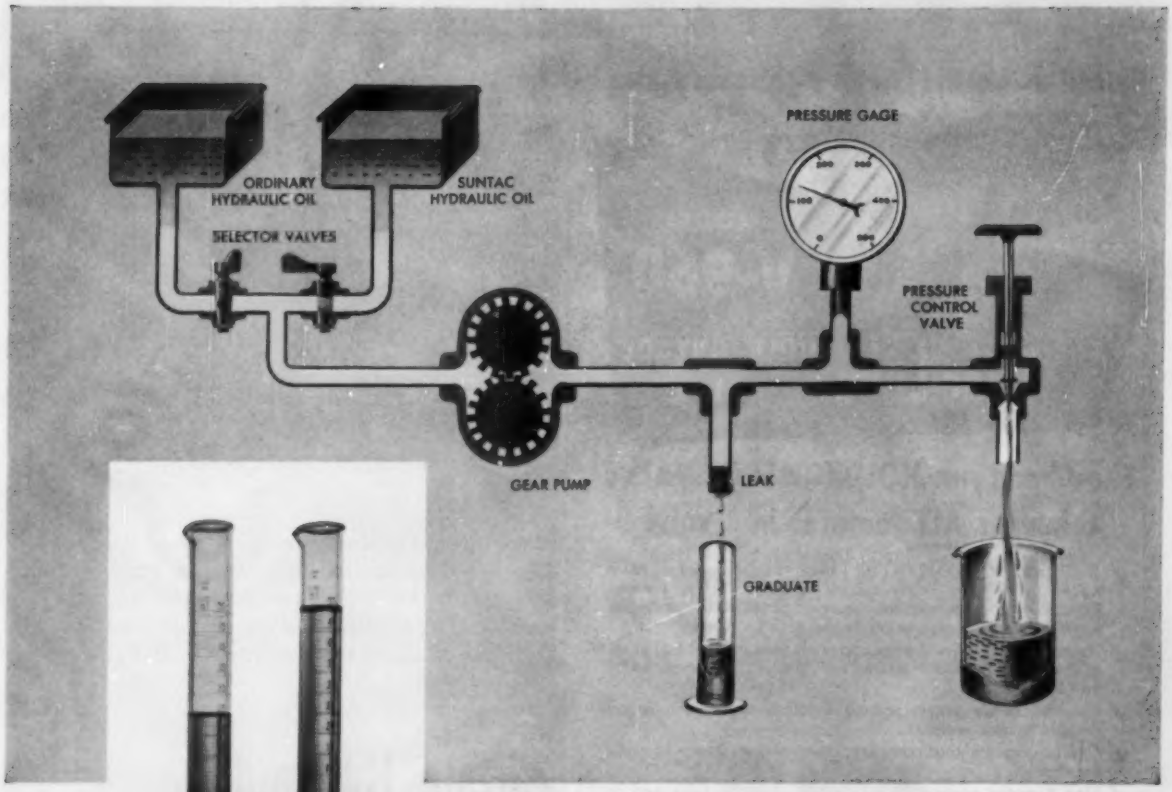
The Fluid Power Industry is a growth industry and the marketing risks are necessarily higher than in more stabilized fields.

MARKETING SESSION—an important area of NFPA activity is opened by New York Air Brake's Bill Lockridge who discussed "How Organized Marketing Can Improve Your Operations".

SALES FORECASTING was discussed by a panel. Here Howard Thompson of Commercial Shearing tells how his company does it. To his left are panel members Dick Pittman, HPM; J. M. Partridge, Valvair; E. L. Holbrook, Westinghouse Air Brake.

• **Principles of Marketing:** Four principles of marketing are: (a) Marketing includes all the functions of moving goods from the producer to the consumer, (b) Greater efficiency is needed in our marketing methods, (c) Marketing aims at profitable business rather than simply volume sales,

Continued on page 222



The leak rate of ordinary oil vs. Suntac was measured in test machine simulating a typical leak in a hydraulic system. Oil viscosities were equal, time and pressure conditions identical. The simple act of switching from the ordinary oil to Suntac, *without any other changes*, reduced oil leakage by 50%.

PRESSURE SYSTEM DESIGNED TO LEAK PROVES SUNTAC CUTS OIL LOSSES UP TO 50%

If you're having troubles with excessive oil leakage, a Suntac® oil can help you. Because of their unusual anti-leak characteristics, Suntac oils reduce oil consumption up to 90%, users report.

Suntac oils will not gum up or otherwise harm circulating systems. These oils are high-quality petroleum products with a life expectancy longer than that of ordinary hydraulic and circulating oils.

A change to a Suntac oil can lower your oil costs...improve housekeeping...result in safer working conditions.

Your Sun representative can tell you more about Suntac oils. Or write for Technical Bulletin 23. Address SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AH-1.

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INDUSTRIAL PRODUCTS DEPARTMENT

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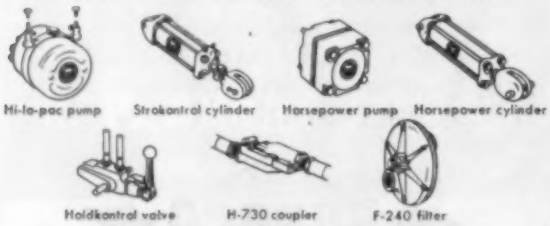
We call it "MARILYN"—it's got everything!

The Char-Lynn HOLDKONTROL VALVE combines ALL features in 1 valve

- ✓ Built-in HOLDKONTROL. This frees the operator from holding the valve in operating position. The valve can be manually returned to neutral, or it will return by itself when pressure exceeds the relief valve setting.
- ✓ Built-in relief valve. Large capacity. Can be set to operate at standard pressure settings . . . 500, 750, 1000, 1500 and 2000 P.S.I.
- ✓ Can be easily converted to control either single or double acting systems.
- ✓ Can be converted to complete manual operation—simple field change.
- ✓ Has 3 point reversible mounting—can be mounted in any position.
- ✓ Will withstand surge pressures up to 5000 P.S.I. It can be safely connected to virtually any hydraulic system.
- ✓ Will sensitively handle volumes from 2 G.P.M. to above 12 G.P.M.
- ✓ Swivel control handle can be rotated through 360 degrees to the most convenient operating position.
- ✓ Special 3-way control without Holdkontrol available for loaders, lift-trucks, etc. Spool change allows operator to inch load up or down.

SPECIFICATIONS

CAPACITY 2 gpm to 12 + gpm • **SAFETY** Relief valve can be set to protect for any range of operation up to 2000 psi • **MATERIAL** Precision-cast body of high tensile strength aluminum bearing alloy. Hardened ground and lapped spool • **PORTS** ¾" N.P.T.—Inlet and outlet.—½" N.P.T.—Cylinder ports • **MOUNTING** Any two of the three pads can be used. Pads reversible for alternate top or bottom mounting • **CONTROL** Spring-loaded . . . Control handle returns to neutral. Handle swivels 360° and may be operated in the most convenient position • **SYSTEMS** Open or closed center. Single or Double Acting. Open free flow or restricted flow • **HOLDKONTROL** Valve will hold when placed in an operating position until it is either manually returned to neutral or until the relief valve operates which releases the lock. This lock can be turned on or off by regulating a screw on operating port face.



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Concluded

(d) Marketing plans must be practical and workable.

• **Sales Forecasting:** How much are you going to sell next year? What will be your volume on each item in your line? Commenting on these questions, E. L. Holbrook, Westinghouse Air Brake indicated that sales forcasting can be used for preparation of budgets, determining sales expenditures, planning sales efforts, and planning product modifications and production. ▼▼▼

Reliability, simplicity and increased service life are what airline maintenance engineers stressed at the 1956 Transport Aircraft Hydraulic Conference, held in Detroit early in November, under the sponsorship of Vickers Incorporated.

Airline Hydraulic Maintenance

. . . Discussed In Open Forum

Here are the highlights of this two-day session, attended by more than 100 representatives of airlines, aircraft manufacturers and component suppliers.

• **Pump Design:** Douglas reported excellent results using Nylon type fixed and floating bearings which replaced the standard bronze bearings on 12 fixed displacement axial piston pumps. No signs of wear after two overhaul periods.

Shaft seal problems were reported by several users of fire-resistant fluid, as the result of swelling of the seal material. Solution has been to grind the shaft and chrome plate.

Vickers reported development work on a new universal joint to minimize knuckle bearing wear.

Bearings were in for considerable discussion. Douglas reported that improvement of the rotating group bearings, in the pump used on DC-7 cabin superchargers, was the principal factor in extending overhaul period to 2000 hours. Improvements include bronze ball separators, replacing micarta;

Continued on page 224

Now...Local Availability on

Titeflex
Flexible Metal Hose

for conveying "Problem" Liquids and Gases!

Titeflex Hose solves scores of problems in conveying organic and volatile liquids as well as corrosive gases. Connects moving and/or misaligned machine parts, other terminal joints. Withstands high extremes in temperature, pressure. Absorbs vibration, shock, and flexing . . . with ease. Sizes 3/16" to 3" Other tough conveyance problems are solved with Titeflex flexible hose made of TEFLON* in sizes of ¼" to 1¼".

Titeflex
Quick-Seal Couplings

—the ideal "connecting mate" for Titeflex Hose or *any other kind of quality hose*. Connects or disconnects in ONE second and . . . the higher the pressure the tighter the seal!

Both these time-tested products are available for immediate shipment from distributors' stocks in most areas. Otherwise write, wire, or telephone direct.

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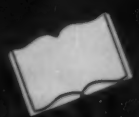

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Your one source for both Hose and Couplings

Titeflex

TITEFLEX, INC., 601 HENDEE STREET, SPRINGFIELD 4, MASS.

Valve manufactured by Koehler Aircraft Products Company, Dayton, Ohio for use in North American Aviation, Inc., F-86 Sabre Jet.

SPARTA'S CUSTOM MOLDED

TEFLON* Ball Seals

Control Air Flow in F-86 Sabre Jet!

The unique combination of properties of TEFLON, combined with Sparta's patented process of custom molding Teflon in Thin Sections and Shapes, engineered to meet exact requirements, permits a practical, economical solution to a critical problem in the manufacturing of the two Ball Seals used in this application. The motor-operated valve—as it is presently used—could not have been designed by employing ordinary flexible materials.

The two seals of Teflon are leak-proof, retain their original size—whether in contact with hydrocarbon fluids, water, air or other elements which would cause swelling in ordinary materials. The extremely low coefficient of friction enables the ball to rotate easily—opening or closing the valve.

Teflon is suitable for use within temperature ranges of —450° F to 500° F, it is flexible and tough, chemically inert, unaffected by corrosives and has extremely high dielectric strength . . . offering design and product-improvement opportunities never before possible.

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Flexible TEFLON Thin-Walled and Spaghetti Tubing . . . available in various sizes and colors.

COMPLETE DATA on properties and applications available without cost or obligation. Write today for our brochures . . .

☐ Sparta Reports on Custom Molded Teflon

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Division of United States Ceramic Tile Co.

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AIRLINE HYDRAULIC MAINTENANCE

Continued

hardening of surfaces subject to wear; finer finishes; modifications to reduce stress concentration.

Reducing end play in a pump to less than .001 —or nothing at all—was stressed by several users as needed to increase service life of certain pumps on some applications. It's a bearing problem which is presently complicated by load ratings and availability of the proper bearings.

Bearing fits were questioned by Pan Am's representatives. How much press fit could be had without shaft close-up or difficult assembly? Bearing representatives said .001 press fit would be

FOUR PAPERS were presented at the conference. Back row, left to right: F. H. Langenfeld, Monsanto, "Hydraulic Fluids"; Frank Monchar, Vickers, "New Trends"; A. R. Civitate, Vickers, "Servicing". Front row, left to right: Conference Chairmen: Paul Humphreys, Capital; and R. B. Ault, Western. W. W. McKenzie, Canadair, "Hydraulic System of CL-28 Reconnaisance Aircraft".

okay. Douglas holds to a .0002 to .0006 interference fit without selective fitting. Vickers has changed drawings to provide .0007 to .0009 press fit by selective fitting.

Improved thrust bearings having a new 20-degree angular contact with satin finish races, in lieu of present 10-degree with polished races, have given good results on service tests. Douglas plans to use this bearing sometime during 1957 when deliveries can be made.

Case leakage is another problem in pump design which was questioned. Relocation of bearings and laboratory tests of ductile iron blocks look promising. Also, failure of aluminum pump yokes has led to the design of ductile iron yokes which will soon be service tested. Weight has been increased a little—about 10 percent.

• **Seals:** Airline men asked about Monsanto's new seal material Vyram. Frank Langenfeld, Monsanto, reported that compounding developments show promise of extending the low temperature operating limit and improving abrasion resistance.

Comments about Teflon for backup rings indicate a trend toward solid rings in preference to spiral. There were reports of corrosion caused by

Continued on page 226

Circle 167 on Reader Service Card

Circle 78 ⟶

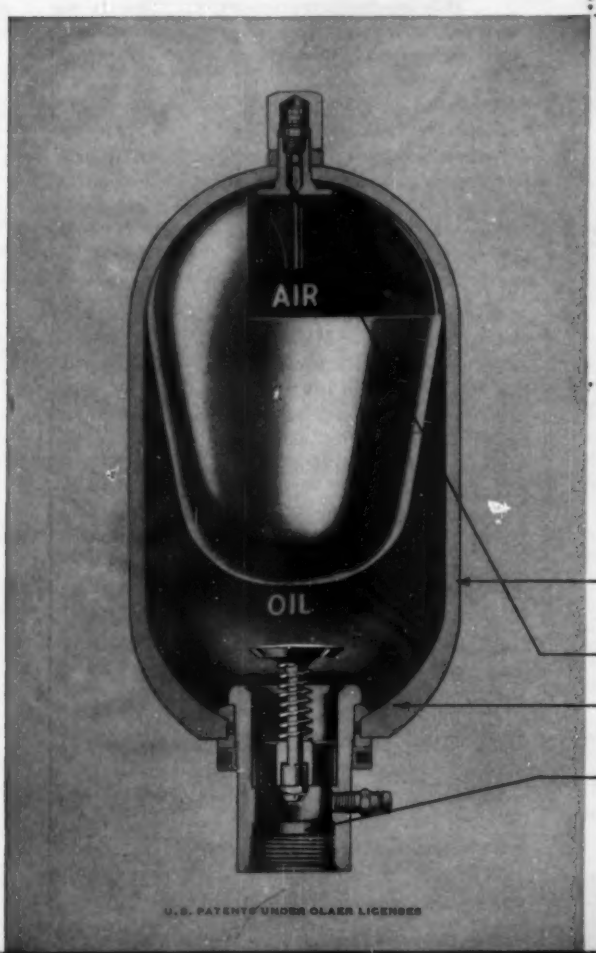
4 Important Reasons for Greer Accumulator Leadership

1 Performance

Today, more than 40,000 Greer Accumulators are in active use. They are found in every conceivable hydraulic system – in trucks, construction machinery, ships, planes, submarines and flying missiles. They power all types of presses, control steel processes, operate electric switches, and absorb pulsations in pipelines. Greer Accumulators are used effectively in almost any industry you can name.

2 Dependability

Greer Accumulators are *rugged* – each is precision-built to take many times the work load that could be reasonably expected. Proof of this fact is provided by the more than 5,000,000 cycles they have experienced. Many Greer Accumulator installations have served 8 years or more *without a breakdown.* Over 6,000 satisfied Greer Accumulator customers is an enviable and unmatched record in this field.



3 Experience

Greer application engineers are specialists in this specialized field. They *know* where accumulators belong for best performance and safety. These men can put many years of *practical* experience to work for you – experience that is hard to find perhaps impossible to match elsewhere. They are available for consultation on your request. Greer field service stands ready to serve users when and where it is needed – *anywhere in the world.*

4 Complete Safety

These exclusive built-in safety features fully protect your men and machines:

SHELL – No welds, seams or joints. Made of single-piece homogeneous chrome molybdenum steel. 18% elongation in two inches prevents crystallization. Safety margin is 5 to 1.

AIR VALVE – Absolutely leak-proof for pressures up to 12,000 psi. Integrally molded, triple sealed to prevent air loss.

MOUTH – Designed to yield at 400% of maximum working pressure. Pressure is released if system is blocked in any way. The Greer Accumulator is BURST-PROOF!

PLUG ASSEMBLY – Accumulator *cannot* be disassembled until air charge is completely released from bag. Lack of this protection has caused serious accidents.

Greer Accumulators meet all J.I.C. safety standards and conform with all safety codes of municipal, state and insurance underwriters in accordance with ASME specification on unfired pressure vessels.

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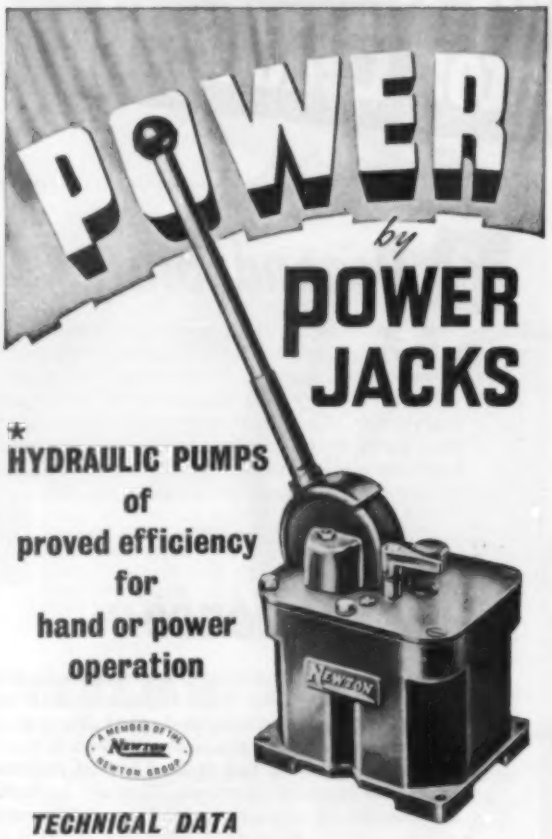

★ **HYDRAULIC PUMPS of proved efficiency for hand or power operation**

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Normal operating pressure . . 1,500 lbs. sq. in.

Maximum operating pressure (Blow off) . . 2,500 lbs. sq. in. (*or to specification*)

Output complete stroke . . . . . ·825 cu. ins.

Effective piston area . . . . . ·600 ins.

Handle leverage ratio 16-1

Alternative fluid capacities in pints . 2¾ pts., 6 pts., 16 pts., 24 pts., 32 pts.

Larger capacities to special order.

Vertical or horizontal pump handle.

JACKS from 1 TON to 5 TONS in a variety of stroke lengths

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TELEGRAMS: NEWSORDER EALUX LONDON ENGLAND

acids retained in leather backup rings. This is one reason United Airlines is using more Teflon. Douglas said they recommend retanned leather which retains a minimum of tanning liquid, which is the source of the corrosion.

What about packing shapes other than the O-ring? Douglas reported tests with "U", "V", "X", "D" and square cross-sections. None has met with the success achieved by the O-ring. Fred Blum of United pointed out that since the groove for an O-ring is not the same as for other cross-sections, changeover of equipment in service is difficult.

Experience in reducing spiral O-ring failure was exchanged. Squeeze, stretching, and groove condition were pointed out as major factors which must be properly evaluated to prevent spiral failure.

. . . this aircraft transport meeting is an annual forum at which airframe builders and airline maintenance engineers meet . . .

Several airlines reported that use of solid Teflon backups has increased seal life.

Because corrosion has resulted from moisture retained by felt wiper rings, some airlines are replacing felt with several wraps of Teflon or with leather. Douglas has removed felt from all production drawings.

• **Fluids:** Commercial airlines are using either petroleum fluid (MIL-O-5606) or fire-resistant Skydrol 500 and Skydrol 7000. Douglas reported that they have been informed the Aircraft Division of Oakite Products may have a moderately priced flushing formulation available soon to be used when changing over from petroleum fluid to fire-resistant.

What is the installation procedure for butyl seals in Skydrol systems? Answering this question, Douglas recommends that all packings be pre-lubricated prior to installation, using the hydraulic fluid in the system or an approved Skydrol grease.

Operators did not report any difference in seal leakage failure between aircraft using MIL-O-5606 and those using Skydrol. Replacement of pump to firewall hose, however, is a different matter. United reported that on DC-6's hose replacement is made after 300 hours with Skydrol, as against 1500 hours with mineral oil fluid. It is hoped that recently developed hose with a harder inner liner will increase hose life on Skydrol systems.

A report by Paul Vance of Monsanto showed results of toxicity tests using Skydrol. It has been found that this toxicity problem only exists when Skydrol 500 is in mist form. Such a condition is unusual and can be easily eliminated before any harmful effects result.

• **Hose:** Discussion centered on Teflon hose development. United said they are looking for a

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INSIDE NEW SUPER AUTO-KLEAN. Line-type housing *(shown)* is only one of many arrangements available for this self-cleaning, micronic filter.

40-micron self-cleaning filter —Cuno's SUPER Auto-Klean

"Most compact micronic filter for its capacity!"

That's what filter engineers say about the new Cuno SUPER Auto-Klean. It's easy to build this latest filter development into engines, machine tools, and industrial machinery for finer filtration of fuel, lube and hydraulic oil, coolant and other liquids. Here's what it gives you:

1. **40-micron filtration** with self-cleaning filter—continuous cleaning with motor drive, intermittent, by turning handle.
2. **No cartridge changes.**
3. **Low pressure drop**—3 psi recommended drop, puts 30 gpm of 200 SSU oil through 8 by 2¼-inch element.
4. **Positive protection** against particles larger than 40 microns (actually 0.0015 in.). Filter can't rupture or channel.
5. **No duplex units needed.** Handles full flow all the time with no interruptions for cleaning.
6. **Standard housings** and types available. Can be easily adapted to new or existing designs with integral mounting or line-type housing.

Write for complete technical data on the new SUPER Auto-Klean filter for *your* design application. Ask for Catalog SAK-057. Cuno Engineering Corporation, 2-1 South Vine Street, Meriden, Connecticut. 57

CUNO *ENGINEERED FILTRATION*

AUTO-KLEAN (edge type) • MICRO-KLEAN (fibre cartridge)
FLO-KLEAN (wire-wound) • PORO-KLEAN (porous metal)

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AIRLINE HYDRAULIC MAINTENANCE

Concluded

3000 psi double wire braid Teflon hose. At present they aren't using any Teflon hose. TWA reported favorable use of Teflon hose at higher temperatures. They put a protective covering over this hose. Aeroquip said single wire braid Teflon in -4 to -16 sizes is available. They're working on a double wire braid hose.

Is there a preference between flareless and flared tube fittings? TWA is using flareless on all new aircraft—DC-8, 707 and Electra. In general, the airlines go along with the aircraft manufacturer's uses. Fred Blum of United reported that a survey, which is still being tabulated, surprisingly indicated a trend for flared fittings, possibly due to the field problems of using flareless fittings.

Because they only want one type on their piston engine fleet, Eastern has standardized on the flared fitting. No decision has been made for their jet airliners.

This discussion indicated:

1. Education on proper installation is still needed.
2. Flareless fittings present an installation problem on tube runs.
3. Flareless fittings are reported to resist vibration better than the flared.

Boeing's 707 will use flareless fittings on 1-inch and under. Larger lines will use flared fittings. ▼▼▼

BOOST
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AIR PRESSURE
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FLUID PRESSURE

Continuous-acting, air-driven. Various ratios give maximum fluid pressures of 100 to 50,000 psi. Size: 8¼" wide x 9⅞" deep.

Eight standard models. Special models for lower or higher pressures. Applicable wherever low-volume output at high pressures is required, such as static testing, powering presses for forming, shearing, clamping, etc. Thousands in use. Low Cost. Complete power packages also available. Send for Bulletins.

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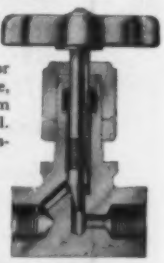
10,000 psi WORKING PRESSURE
FORGED BODY

One-piece, stainless steel, forged body and stem guide, with no brazing or welding—*can't* leak or come apart. Has many uses in water, gas, oil, and vacuum service.



Proofed at 25,000 psi for 10,000 psi working pressure, to 200° F. Semi-needle stem of *hardened* stainless steel. Available with graphited asbestos or Teflon packing.

Easy grip handle. Panel mounting. Female pipe connections, sizes ⅛" up to ½".

Ask for new catalog No. 654, showing entire line.

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ASTM SYMPOSIUM

. . . Covers testing and application of high temperature hydraulic fluids and components

First symposium of Technical Committee N, Section I of the American Society for Testing Materials was held in September at the Statler Hotel in Los Angeles. Approximately 125 representatives of various aircraft, component and hydraulic fluid manufacturers attended. Purpose of the symposium was to acquaint the manufacturers and users of high temperature hydraulic fluids and components with problems of testing and application.

• **Section I:** P. H. Stafford, Autonetics Div., North American Aviation is Chairman of this section of ASTM committee N. Section I is concerned with testing of fluids for aircraft use.

• **Problems:** Four papers were presented, outlining specific problems and approaches to their solution: "Mach Numbers, Hydraulics and the Slaying of Dragons", Charles E. Hamlin, North American Aviation, Inc.; "Design and Operation of a High Temperature Hydraulic Test Facility", Dr. L. H. Smith, General Electric Company; "Filtration Study to Determine Test Methods", J. G. Pepper, Convair; "Spontaneous Ignition Temperature as a Function of Altitude", Dr. H. G. Zabetakis, U. S. Bureau of Mines.

• **Radiation:** B. Rubin, of Wright Air Development Center, was asked at a recent Section I meeting about the radiation work he and his staff had done. He stated that WADC had looked at some hydraulic fluids, including silicate-ester fluids. Some results of their work indicated a general change in viscosity and acidity. Some formation of gas was noted, and in some instances the lubricity of the fluid was improved.

• **Future Event:** Another symposium sponsored by Section I will be held during the week of February 11th in New Orleans. This will be part of an ASTM program taking place that week. ▼▼▼

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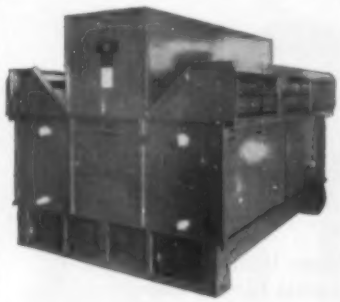

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District Engineers in Principal Cities of U. S. and Canada

IDEAS *from a Sales Engineer*

L. IRWIN WALLE

You can almost hear Irwin Walle's wonderful British accent as you read this column. After years of engineering design work, Irwin joined the John Spotton Company, Ltd., Toronto, Canada, sales staff in 1953. About this column he says, "This article tells how a sales engineer can be of assistance based on our observations in Canada". His ideas hold true for the good old U.S.A. too.

Push the Peddler

There is always a certain thrill in watching a new machine start up. When the great moment arrives, it is not uncommon to see the high brass in full attendance, competing with each other for the privilege of pressing the button.

A short time ago, we had the pleasure of watching a new machine go into production. It was entirely automatic, substituting fluid power in the place of a dozen men. The experience was even more gratifying than usual, as we had been directly associated with the development of the machine. We were subject to the same reactions as the engineers in charge and we were hastily re-checking the circuit even as the starting button was pressed. Although we had sections of the machine working in the toolroom previously, it took us about an hour to adjust it to work as a complete unit. It was during this period, when we were lying underneath the machine, covered with oil and straining to reach a particularly difficult speed control valve, that it occurred to a member of the brass to ask what a valve peddler was doing in such a position.

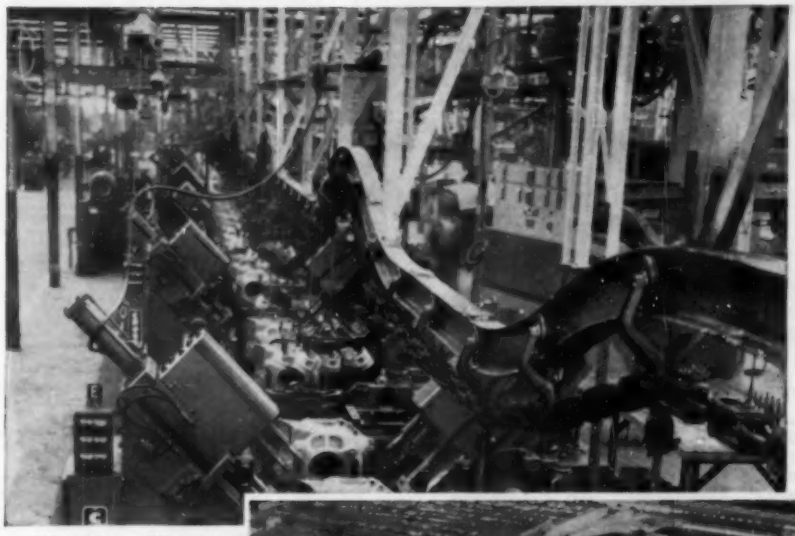
This question is constantly occurring. There are numerous advertisements appearing in this and other technical periodicals, which indicate that the customer is getting something for nothing when he uses the technical services of a representative. Actually it would appear to be the other way around; the customer will pay the same price for the product whether he uses the technical service or not. In this case, if he does not take advantage of everything the supplier can provide, then he is paying for something which he does not receive. As no single company is large enough to retain sufficient engineers to specialize in every branch of the engineering field, it is only common sense to use any outside information readily available; but here's the rub.

Let's Match Questions

When an engineer wants information, nine times out of ten he wants it fast. A direct answer is required and a representative who duly shows up, takes copious notes and departs to refer the matter to his own engineers, is of no use whatsoever. Especially when he returns after a week's interval with a list of questions issued by his own engineering department, usually for answers which the engineers concerned cannot supply.

When the equipment is of foreign manufacture and correspondence takes some time in passage, this procedure is worse than useless. In any case, it leaves the engineer with the impression that the supplier is merely trying to avoid making a definite statement concerning his product. The answer to this pitfall is the ability of the representative to deal with

In the Spectacular PLYMOUTH ENGINE PLANT you see



(Above) View of Plymouth Engine assembly line

VICKERS® HYDRAULICS

Wherever You Look

Plymouth Engine Plant is 980' long and 500' wide. Indicative of its scope is crankshaft machining requiring 4500 linear feet of automation composed of 385 individual units. Plant capacity is 150 engines per hour.

In the new Plymouth "Qualimatic" Engine plant you see Vickers Hydraulics on every side. Hundreds of machines in this latest and greatest example of automation are Vickers equipped.

Both builders and users of production equipment appreciate the significant advantages of Vickers Hydraulics . . . advantages that help produce better products at lower cost.

A specific need in the Engine Plant is standardization on a few basic hydraulic units to keep down parts inventories. The Vickers line makes standardization easy. Also desirable are hydraulics in units quickly demountable . . . so that by replacing units, repairs on the job are avoided and costly downtime reduced. Vickers has extensively developed demountable unit construction.

Whether automated or not, more and more plants have more and more Vickers Hydraulics. For further information, write for Catalog 5002B.

VICKERS HYDRAULICS is used on machines supplied by these Companies to Plymouth Engine Plant

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Barnes Drill Company
Bilt-Rite Tool & Machine Co.
Buhr Machine Tool Company
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The Cross Company
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Industrial Metal Products
The LaPointe Machine Tool Co.
Landis Tool Company
The R. K. LeBlond Machine Tool Co.
Lees-Bradner Company
Michigan Drill Head Co.
Micromatic Hone Corporation
Micro-Poise Engineering & Sales Co.
Modern Industrial Engineering Co.
The Natch & Merryweather Machinery Co.
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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

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Hydraulic equipment manufacturers are now taking a *second* look at the many advantages of "John Crane" CHEMLON hydraulic packings and offering them in place of leather, fabric-reinforced and similar packings.

THE REASON . . . CHEMLON provides several very important service advantages.

1. Increased cylinder life due to the inherent non-frictional qualities of CHEMLON.
2. Longer packing service life—CHEMLON outlasts all other types of packing to a remarkable degree . . . decidedly cuts replacement, down time and maintenance.
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"John Crane" CHEMLON–*The Best in Teflon*–offers a complete line of piston cup, "U" cup and flange packing for every service requirement.

Get the new bulletin No. P-322 on "John Crane" Hydraulic Packings.

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*"John Crane" fabricated from DuPont Teflon

CRANE PACKING COMPANY

most problems himself. In the hydraulic and pneumatic fields, this is essential, as very few plants have an engineer who specializes in either.

Help the Little Fellow

We have noted a certain reticence in making use of sales representatives, especially in large plants. Smaller businesses are apt to go to the other extreme, expecting the sales engineer to design the whole machine and also to install the equipment. This is rather too much, but helps to explain why a small business will often produce a component much cheaper than its larger competitor. This small manufacturer has dispensed with the need of maintaining a drawing office or designers; he has used the cheapest system and components available without the aid of a costing department or purchasing agent; he has in fact received several thousand dollars worth of services which would normally be carried in overhead expenses to the product. Not only has he received these services free of charge, but the cost of these services (Oh, the injustice of it!) is borne by his larger competitors, whose substantial orders keep the sales engineers in bed and board.

Now, before it is concluded that the best solution to the problem is to get rid of all sales engineers, consider what happens in a large organization when it is discovered that the small competitor has seized its market. Invariably the first move is to fire the Sales Manager, but eventually it will be agreed that certain machines in the plant are antiquated and are holding down too many men.

Cut Development Costs

When the decision to build new machines is reached, there is a great huddle and all departments concerned state their requirements. Perhaps even a basic design is worked out, but it usually falls to one engineer with his staff of draftsmen to produce the machines.

The large organization, with

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it's NEW!

5/8 INCH BORE

AIR-OIL CYLINDER

If you've been using 1" or larger bore cylinders for those applications in which you wanted the "smallest" bore, here are some of the benefits you'll derive from the new AIROYAL ⅝" bore cylinder: more compact size; reduced thrust from a given pressure; lower piston and rod inertia; increased velocity from a given flow input.

Cylinders are available single and double acting in all mounting styles. And you'll appreciate the low price—only $28.00 list for pressures to 750 PSI, $32.00 for pressures to 1500 PSI.

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A NEW GRESEN VALVE With FLOAT Position

GRESEN HYDRAULICS

A Two Spool Directional Control With Float

FEATURES: Detent in Float Position—Self Centering From Power Positions—Fully Balanced—Relief Valve Has Replaceable Hardened Seat—Tripod Mounting Feet—Smooth Positive Throttling Action—Hardened and Chrome Plated Spools.

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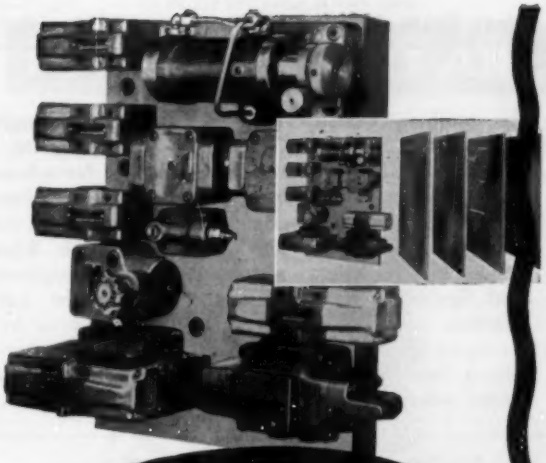

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HYDRAULIC CONTROL MANIFOLDS

CONTROL SYSTEMS READY FOR OPERATION — NO CIRCUITS TO PONDER OVER AT INSTALLATION

Leading machine manufacturers use these manifolds to cut costs and obtain permanent trouble-free operation. Send your hydraulic circuit print and sketch showing desired take-off connections. We'll prepare a manifold proposal—No obligation.

Write for full details

ALMO TOOL COMPANY
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"Design Wise"

Colonial Broach Co. uses an Almo manifold in this 15 ton capacity, 66" stroke dual-ram broaching machine.

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Continued

the enormous resources for development it has at its disposal, can quite easily approach a problem from the wrong angle. Although a machine is eventually built that will do the job, costs of development rise to astronomical figures and very often the machine never does operate to complete satisfaction. We can cite a dozen instances in our locality where this has happened. The sales engineer has been called in when the machine has been too far advanced to change the basic structure and it becomes a question of making the best of a bad job. When this happens, the plant engineers are apt to howl that the equipment used was quoted on by the sales engineer concerned, or that the circuit has been approved by him. It must be fairly obvious, that once an engineer has decided what equipment or circuit he is going to use, the sales engineer has no alternative but to quote on it. The fact remains that, although a certain sequence of valves will produce a required movement, or certain cylinders will lift a given load, this is no guarantee that they are suitable for the application concerned. We have been asked, for instance if a 2" diameter cylinder would push a certain load and answered in the affirmative. It was not until some time later that we discovered that a 10 foot stroke cylinder of this diameter had been mounted in a horizontal position, mounted on the rod end only and subject to considerable vibration. In another case, we approved a circuit for an ejector movement which involved a number of light, die-cast valves and cylinders. We actually set the circuit up on a test bench before committing ourselves but this did not prevent our being in trouble when, mounted on a steam hammer, the valve bodies became so distorted they failed to operate.

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OIL-RELIEF BY-PASS VALVES

PRE-DETERMINES OIL PRESSURE ON TORQUE CONVERTERS

Constant, uniform oil pressure is an important factor in satisfactory performance on thousands of hydraulic applications . . . just as on these torque converters.

You may not make torque converters or use them . . . but you probably NEED FULFLO VALVES in your particular equipment. The FULFLO ENGINEERS can help you on your hydraulic problems. It's yours for the asking.

Note the installation on the torque converters used by Twin Disc Clutch Co., Rockford, Ill.

6 springs for pre-determined pressure from 0# to 500#; pipe sizes from ¼" to 2"; standard or flange models.

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NEW MECHANICAL DATA BOOK.
Colorfully illustrated.

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THE FULFLO SPECIALTIES CO. Inc.
PUMP AND VALVE MANUFACTURERS
BLANCHESTER, OHIO

Give Us Enough Facts

It is very seldom that a sales engineer is called into the engineering department of a large organization and asked "We have to design a machine to produce this. Have you any suggestions?" Yet if the question was asked "How much time and money is wasted thinking of ways to accomplish an operation, when that same operation is being successfully carried out in a dozen other plants?", the answer would be quite different. Or if we were asked how many times we have supplied a relief valve for a vastly overrated flow, our fingers would not suffice for the counting. Our job is to sell fluid circuits. We must admit, however, that fluid power is not always the answer to a problem. Electrical and mechanical methods are, in some instances, less expensive and more practical. There are sales engineers specializing in these aspects too and the plant engineer who calls them in from all fields, considering all their proposals before deciding upon one method of approach, is not only making

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Seals off gage or manometer connection at any pre-set pressure. Will repeat within 1% of scale. Will release 2% below cut-off point.

Models available with cutoffs from 20" water to 9000 psig. liquids and gases. Designed to withstand and hold closed against 10,000 psig.

Marine models available.

Write for Bulletin 541-G for full details and prices.

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FOR CLEAN, DRY AIR

Distributing Line Of Cool Air From Receiver Tank
Vapor Free Air Near Point Of Use
Take Off From Top Of Pipe
Replaceable Desiccant

MURPHY TRIUMPH AA SEPARATOR-FILTER
Sizes: ¼, ⅜, ½, ¾; Weight 30 lbs; Pressures: 0 to 125 psi; Price: $81.65 ea; Desiccant refills $1.00 ea.

After precooling and separating compressed air, this small unit, placed close to the point of use will finish the job of removing last traces of impurities.

Where very particular work demands dry air completely free from any trace of oil or vapors Murphy Triumph AA is the answer.

AFTERCOOLERS FOR 10 CFM TO 10,000 CFM—SEPARATORS—TRAPS

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Hamilton, Ohio

. . . a large range to choose from

Baldwin Pneumatics enable you to choose from probably the largest range of pneumatic equipment in the U. K. No fewer than 336 standard types of double-acting air cylinders are available —at competitive prices and with prompt delivery. Baldwin air cylinders are ruggedly built and are thoroughly reliable in even the most arduous working conditions.

Baldwin Pneumatics also manufacture a wide range of top quality control and pilot valves, and associated accessories which will adequately cover all your requirements.

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Circle 143 on Reader Service Card

DOUBLE DISC GRINDING

Our Double Disc Grinders
SPEED PRODUCTION and SAVE $$$
by grinding 2 surfaces Flat and Parallel in one operation.

TOLERANCES IN LOW TENTHS

Piece parts may be rectangular or round flat discs, or flimsy castings in any materials. All parts are inspected in our air conditioned inspection room—equipped to measure in "millionths."

We service customers from Maine to California

WRITE for BROCHURE

PRECISION DISC GRINDING CORP.
57 MESEROLE AVE., BROOKLYN 22, N. Y.
PHONE: EV 3-3720

Ideas from A Sales Engineer

Continued

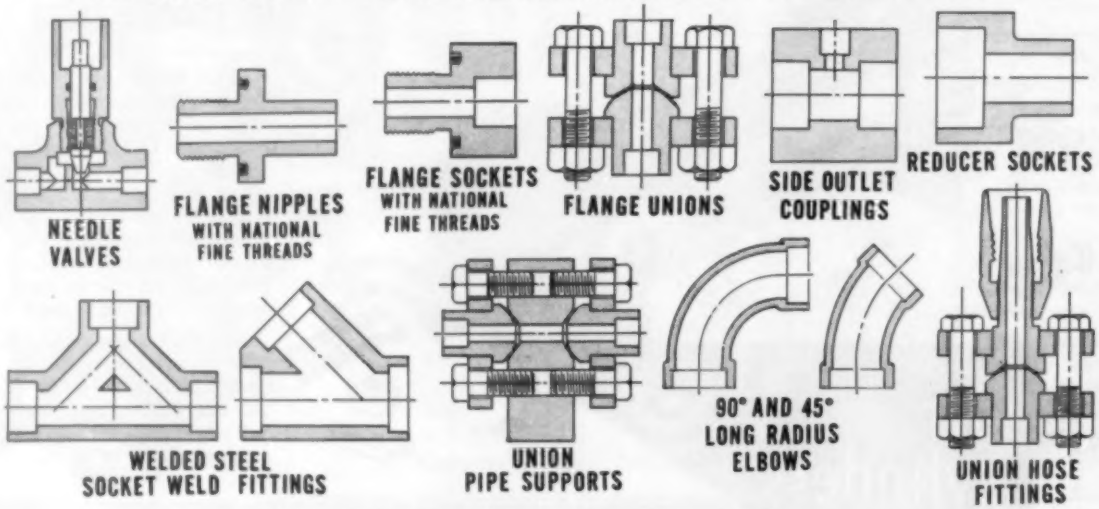
his own life easier, but is performing an important part of his duties and a service to his employers.

New machines are not always the answer to the immediate problem at that. Remember that the competitor is already producing and rapid action is required. New machines, however advanced, take time to build. What is to happen in the interim period? In this case, a sales engineer can be of extremely valuable assistance. Almost any movement, or series of movements, an operator can make, may be duplicated, automatically, by an air or hydraulic circuit. His first hand knowledge of the material available is the chief asset in this instance and it is surprising what the addition of a few valves and cylinders can do for an old machine.

The sales engineer is a comparatively new role in industry and, like a new tool, he is apt to be left on the bench, too shiny and new to be used, while fingers are scraped and tempers get short attempting to carry on with the old wrench. His job is to sell, and to do this he must look like a salesman, be prepared to play golf with the President, discuss technical and maintenance problems with the engineers, costs with the Purchasing Agent and to be able to make a list of spare part requirements for the storekeeper. He must be prepared to draw up a circuit and furthermore, to see that it works. His job does not stop here however, as an engineer he must realize the importance of keeping a machine in operation once it is installed. Consequently it is the sales engineer who is hauled out of bed in the middle of the night by a harassed maintenance foreman who lacks a certain spare part (a practice severly frowned upon by said sales engineers). He is the one who induces a manufacturer to ship the part by air, or borrows it from another plant where he knows they have a spare one. In short, he is a very active cog in the industrial machine. ▼▼▼

Specify **ALMAR** *THE NEW STANDARD*

FOR SOCKETWELD HYDRAULIC FITTINGS . . . NO PIPE THREADS!



COUPLINGS, CAPS, PLUGS, AND REDUCER INSERTS

Hydraulic Controls and Systems
We engineer complete hydraulic circuits

ALMAR HYDRAULIC VALVE COMPANY

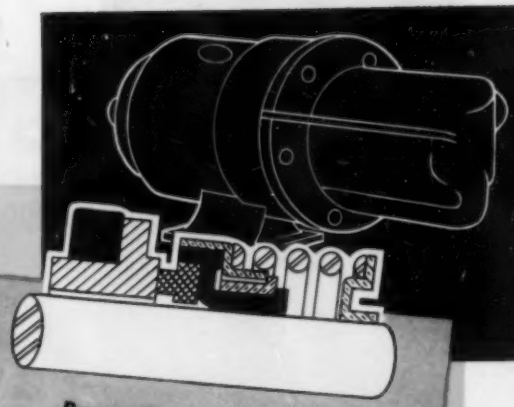
10011 Meech Ave. Cleveland 5, Ohio

Circle 12 on Reader Service Card

Circle 75 →

Machine Tools And Power Transmission Equipment

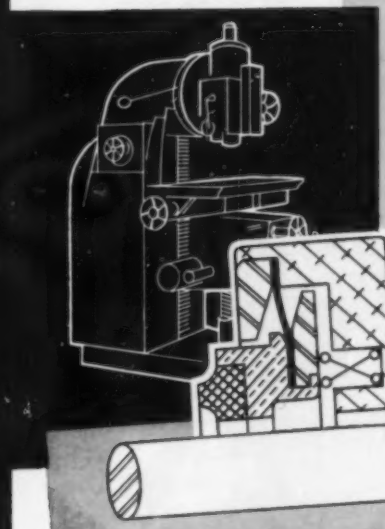
STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.



Pumps And Compressors

ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.



Heavy Machine Tools

STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.

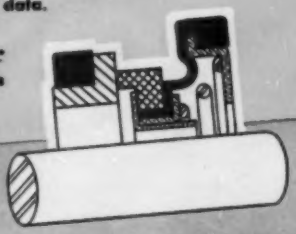
A Complete Line
GITS SHAFT SEALS
For Every Application

These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.

GITS BROS. MFG. CO.

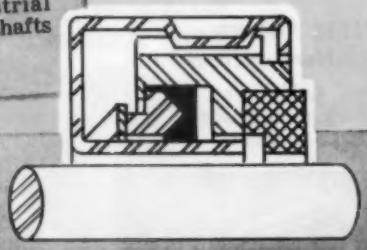
1846 South Kilbourn Avenue • Chicago 23, Illinois

Specialists In Lubricating Devices And Shaft Seals For Almost Half-A-Century



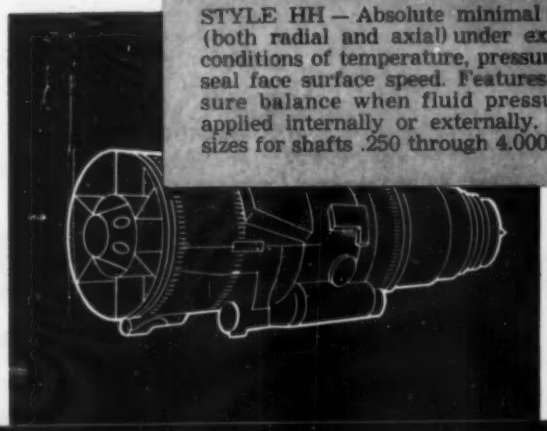
Household Appliances

STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.

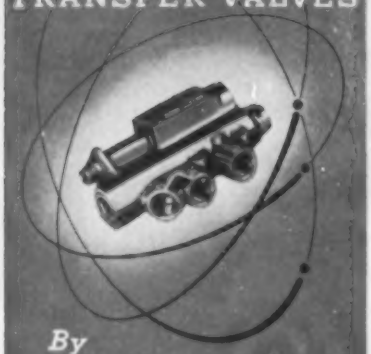


Aircraft Engines And Accessories

STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.



TRANSFER VALVES



By
M.C. MFG. CO.

The one shown is:
MC 1750 VALVE — TRANSFER SOLENOID OPERATED
fulfilling the following aircraft specifications:
FLUID: MIL-O-5606 Hydraulic Oil
OPERATING PRESSURE: 1500 psi
TEMPERATURE RANGE: —65°F to +165°F
PORT CONNECTIONS: Per AND 10050-8
INTERNAL LEAKAGE: 5 cc/min. max.
PRESSURE DROP: 25 psi at 6 GPM
SOLENOID: Applicable paragraphs of specification MIL-S-4040 Continuous duty .75 amps max. at 24 volt DC
OPENING OR CLOSING TIME: .10 seconds max. at rated pressure and flow
WEIGHT: 2.65 lbs.
MILITARY SPECIFICATION: Applicable paragraphs of MIL-V-5529 Non-interflow type

Hydraulic and Pneumatic Components for the Aircraft Industry

VALVES OF ALL TYPES: Relief • Solenoid • Manual Control Transfer • Shuttle • Brake • Control • Fluid • Pressure Reducing Restrictor and Special

ALSO: Air Compressors • Fuel Pumps • Dehydrators

M.C. MANUFACTURING CO.
118 INDIANWOOD ROAD
LAKE ORION, MICHIGAN

West Coast Office: 716 Wilshire Blvd. Santa Monica, Calif.

Representatives:
D. & O. ENGINEERING CO.
P.O. Box 3107, Wichita, Kansas

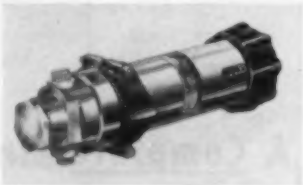
L. YOUNGS
7520 12th., N.E., Seattle 15, Wash.

F. C. MINCH
1132 Donson Drive, Dayton 10, Ohio

New Products continued

HIGH FLOW REGULATOR
. . . offers wide range

Features: With inlet pressure of 6000 psi, unit maintains regulated pressure from zero to 5000 psi. Maximum burst pressure is 15,000 psi. Handle torque is only 30 in-lbs. due to planetary gear system in handle. Regulator is also adaptable for use with air. Internal valve and filter are removable without disturbing spring diaphragm structure.



Specifications: Available in ¼-inch tube AND10050 straight thread gasket seal bosses and in AND10053 ¼-inch pipe thread. Unit has bubble-tight shut-off, adjustable mounting, internal 5 micron filter and internal relief valve adjustable over entire outlet pressure range.

Accessory Products Corp.
Whittier, Calif.

Circle 228 on Reader Service Card

SEAMLESS TUBING
. . . offers accurate I.D.

Features: Cold drawn seamless steel tubing, made to accurate inside diameter, is available from stock.

Honing the inside surface to required smoothness provides low cost material for production of honed cylinders.

Specifications: Available in sizes from 2 to 9 inches O.D. Tubing is premium quality, made to close I.D. tolerances with exceptionally smooth inside surface.

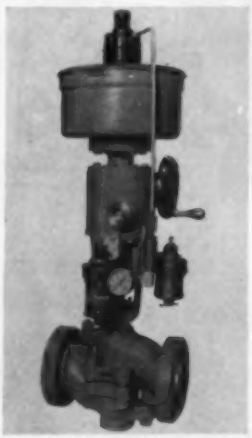
Joseph T. Ryerson & Son, Inc.
Chicago, Ill.

Circle 229 on Reader Service Card

AIR POSITIONED ACTUATOR
. . . also has handwheel

Designation: Cono-Clutch Hand Operator

Features: Accessory is integrally mounted for standard line of actuators. Unit affords manual control in event of air failure. Can be instantly thrown in and out of gear at any position of stem travel. Clutching and declutching are accomplished by pulling or pushing



knob on face of unit. No special tools required. With handwheel in de-clutch position, there is no interference with free stem travel. Unit is compact, streamlined, without protrusions or extensions. Gears are enclosed in aluminum, dirt-tight housing with alemite lubrication fittings.

Conoflow Corporation
Philadelphia, Pa.

Circle 230 on Reader Service Card

AIR CYLINDER
. . . has vertical flange jaw

Designation: Models 715, 820

Features: Cylinder is heavy duty type with bronze piston head, float-

Continued on page 240

Circle 116 on Reader Service Card

MARSHALLTOWN

THE RIGHT GAUGE FOR YOUR SPECIFIC NEEDS

- PRESSURE
- VACUUM
- COMPOUND
- ALTITUDE
- COMBINATION
- DIAPHRAGM
- HYDRAULIC
- AND SPECIAL PURPOSE GAUGES
- DIAL THERMOMETERS

(Vapor Tension or Bi-Metal)

• Available in a wide variety of general purpose and special purpose gauges in pressure ranges to meet your specifications in every particular.

WRITE TODAY FOR COMPLETE INFORMATION

MARSHALLTOWN MANUFACTURING CO.

800 EAST NEVADA ST.
Marshalltown 4, Iowa

Check with LYNAIR FIRST!

ON YOUR AIR AND HYDRAULIC CYLINDER REQUIREMENTS

REGARDLESS OF YOUR NEEDS WE CAN SUPPLY THEM

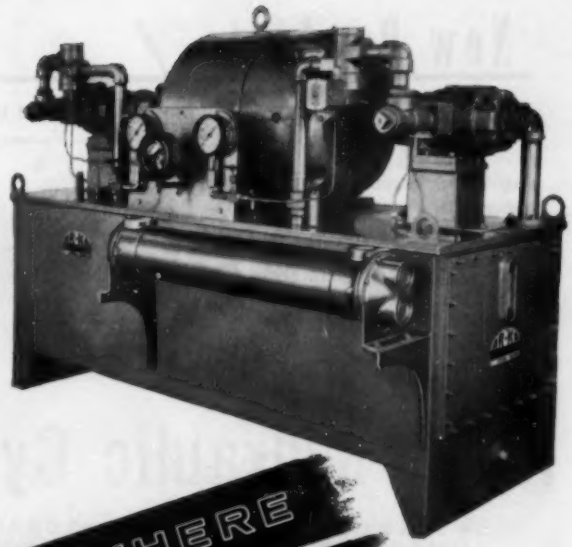
Check these Advantages

- √ We engineer and manufacture Air and Hydraulic Cylinders for every application
- √ Cylinders meet J. I. C. standards
- √ Airdraulic cylinders for controlling feed in both directions
- √ New design Piston Packing assures minimum of bypass on hydraulic cylinders
- √ Complete range of sizes, 1½" bore through 8" bore, standard. Larger sizes on request.
- √ A full range of Air and Hydraulic Boosters.

Delivery to meet your requirements.

WRITE FOR NEW CATALOG

LYNAIR Inc. 3100 E. MICHIGAN AVE. JACKSON, MICHIGAN



WHERE QUALITY COUNTS

Young HEAT EXCHANGERS

Are Available in Standard Models or Special Designs for Industry

Again Young is the solution to the need for a heat exchanger on a specialized piece of machinery. This special hydraulic package unit —designed and built by Hydro-Air Engineering, Inc., St. Louis, for a large midwest automotive plant—supplies fluid power to a large die-casting machine. The entire return oil flow of 65 gpm is directed through the Young Heat Exchanger for cooling.

Your requirements can be filled, too, by specifying Young standard or special Heat Exchangers—they're always used *where quality counts.*

Write Dept. 447-A for FREE Catalog

Young RADIATOR COMPANY

RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

Circle 113 on Reader Service Card

Circle 205 on Reader Service Card

New Products continued

ing bronze cushion, cartridge-type rod packings, chrome plated, full-diameter piston rod, U-type piston packings and O-ring cylinder seals. Jaw assembly will unload stampings having vertical flanges at pick-up point, and fits conventional air-powered straight-line or swinging arm type press unloaders.

Specifications: Each model has 1-¼-inch jaw opening. Model 715 has 7-inch stroke and 1-½-inch diameter cylinder. Model 820 has 8-inch stroke and 2-inch cylinder. Larger strokes are available.

Press Automation Systems, Inc.
Detroit, Mich.

Circle 231 on Reader Service Card

TUBE BENDER
. . . saves material

Designation: Staffa

Features: Tube is formed by compression bending over machined center forming die and slipper. Throat ratio of bend is three times diameter. Bends up to 180 degrees

can be produced cold, unloaded and free from flattening and wrinkling. Change in bending direction from right to left is accomplished in seconds. When bending arm returns to pre-bending position a device automatically ensures correct angle of lead prior to the next bend. Unit can bend air and hydraulic lines up to 1-½ inches.

Chamberlain Industries Limited
London, England

Circle 232 on Reader Service Card

POWER UNIT
. . . is more compact

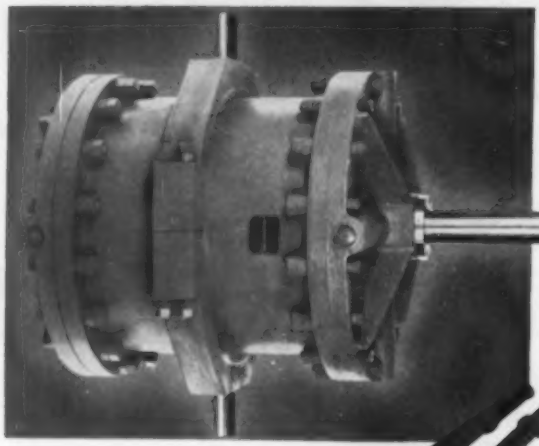
Designation: Varidyne

Features: Designed with drive motor and alternator on same side

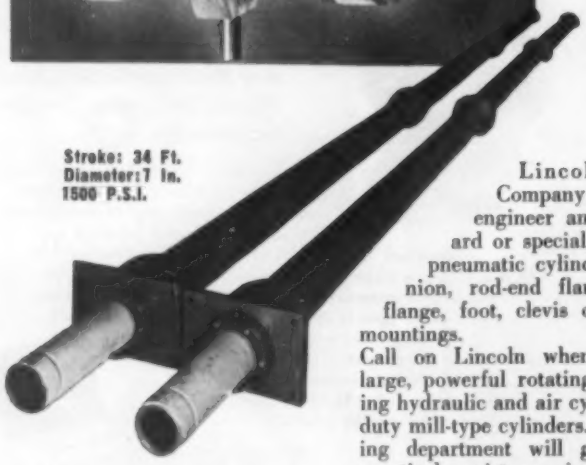
to save space. System converts standard 60-cycle, 3-phase, AC squirrel cage motors into variable speed motors. Alternator is driven at variable speeds and generates frequency proportionate to its speed. By changing speeds at power unit

Air & Hydraulic Cylinders

• FOR HEAVY-DUTY APPLICATIONS OF ALL TYPES • TO MEET ALL SIZE AND PRESSURE REQUIREMENTS • BORES TO 32" DIAMETER • STROKES OF 50 FT. AND LONGER.



Stroke—13½ Inches
Diameter—24 Inches
200 P.S.I. Air Pressure



Stroke: 34 Ft.
Diameter: 7 In.
1500 P.S.I.

Write today for Lincoln's catalog. It gives engineering data on many types and sizes of heavy-duty cylinders.

Lincoln Machine Company will design, engineer and build standard or special hydraulic and pneumatic cylinders with trunnion, rod-end flange, blank-end flange, foot, clevis or centerline mountings.

Call on Lincoln when you require large, powerful rotating or non-rotating hydraulic and air cylinders, heavy-duty mill-type cylinders. Our engineering department will give you fast, practical assistance in design problems . . . and our modern plant will build your cylinders quickly and economically.

LINCOLN MACHINE CO. INC.
P. O. BOX 272 • SALEM, OHIO

with handwheel, each motor in the system varies equally and simultaneously. System is easy to understand, service and install. When motors are operating in tandem, the load is shared equally, eliminating damage from overloads.

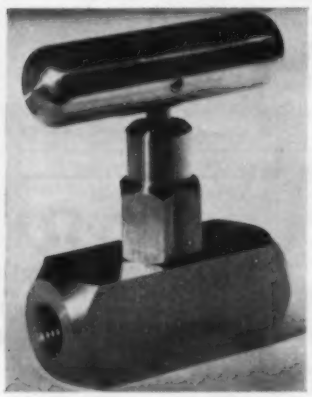
Specifications: Available in wide range of enclosures and speed ranges. Speed ranges from 1 to 10,000 rpm in ratios up to 5:1, with 1/3 to 30 hp at maximum rpm. Units are available to carry from 1 to 60 hp connected load.

U. S. Electrical Motors, Inc.
Los Angeles, Calif.

Circle 233 on Reader Service Card

METERING PLUG VALVE
. . . has replaceable seat

Features: Valve incorporates a nylon seat and is made from stainless steel barstock. Plastic seat withstands metering action and provides leak-proof shut off action unless severely damaged. Straight through



high volume passages and non-lubricated rising stem design eliminates flow against stem seat and threads.

Specifications: Teflon can be furnished as an alternate material for the seat. Available in sizes of 1/8, 1/4, 3/8, 1/2 and 3/4-inch with NPT connections for service up to 6,000 psi on water, oil or gas.

Anderson, Greenwood & Co.
Bellaire, Texas

Circle 234 on Reader Service Card

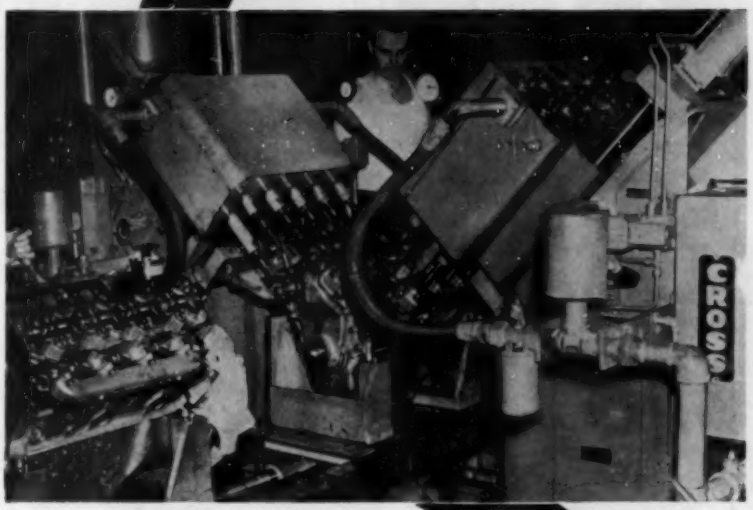
RUBBER ADHESIVE
. . . bonds rubber to metal

Designation: Duolock

Features: System combines Duolock primer with appropriate Duolock tie coats. Possible pneumatic

Continued on next page

For Assembly Line
DEPENDABILITY



IT'S STRATOFLEX
HOSE and FITTINGS

Stratoflex Hose and Fittings were selected for this Thor 22-unit Multiple Nut Setter, engineered by the Cross Company and installed in the new Plymouth engine plant at Detroit. Stratoflex is specified in many similar hydraulic and pneumatic applications because of the flexibility, durability and small bend radii of Stratoflex Hose . . . and because Stratoflex Fittings assure leak-proof connections, are quick on-and-off, detachable and reusable. Available in a complete line of sizes and types for all industrial uses.

Order from your supply store or write for Bulletin S-2.

STRATOFLEX Inc.
P. O. Box 10398 • Fort Worth, Texas
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Sales Offices:
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Kansas City
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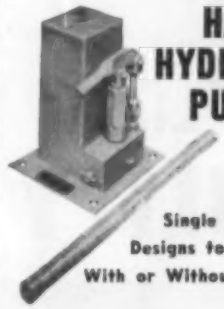
Circle 173 on Reader Service Card

Circle 139 on Reader Service Card



HAND HYDRAULIC PUMPS

Single and Double Designs to 20,000 PSI With or Without Reservoir

160 Cubic Inch Reservoir with 8" x 8" Base Plate. Optional Size Piston: ⅜", ½", ¾", 1".

Handle length: 18 inches

Catalog No. 160

We specialize in hand pump units to operate in temperatures from minus 65F to plus 160F and with any capacity reservoirs required.

The single pump with ½" or ¾" piston now available in stainless steel.

WILLIAM S. PINE

Hydraulic Hand Pumps for 1001 Uses

1635 E. 22nd St., Los Angeles 11, Calif.

New Products continued

or hydraulic applications might be motor mounts, gaskets, fittings, and other rubber-to-metal requirements. Primer is a free-flowing black liquid, supplied at 95 centipoise viscosity, solids content 22 percent and suitable for brushing.

B. F. Goodrich Industrial Products Company Div.
Akron, Ohio

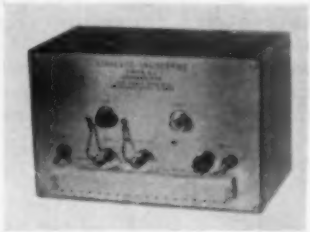
Circle 235 on Reader Service Card

NEW SERVOAMPLIFIER . . . offers high gain

Designation: SA60C-4

Design: Primary actuating signal is a variable carrier voltage produced by linear variable differential transformer or other means.

Specifications: Line power: 105-130 volts, 60 or 400 cps; power consumption: 30 watts nominal; max. carrier output: 4 watts; min. input for full output power: 90 microvolts input impedance: 20 megohms shunted by less than 25 mmf'd.,Carrier frequency: 60 or 400 cps; dimensions: 9⅛" long,



4¾" deep, 5¾" high; output load impedances: 2000, 2500, 3200, 4000, 5000 ohms (internal transformer taps).

Schaevitz Engineering
Camden, N. J.

Circle 236 on Reader Service Card

AIR OPERATED VALVES . . . handle air at 10,000 psi

Designation: Series 200

Features: Designed to handle air at pressures up to 10,000 psi, valves

Continued on page 244

NEW PATENTED GLAND DESIGN means Easier Maintenance for Hydraulic Cylinders

Quick, easy changes of V-Ring packing and perfect rod alignment are assured by Densmore's patented gland design and method of prestressing the snap ring within the cylinder. Big savings in maintenance costs . . . better operation under all conditions.

Inquiries Invited from Manufacturers Agents and Distributors

DENSMORE ENGINEERING CO.

235 E. Greenleaf Street, Compton, California

TRU-O-SEAL TEFLON SEAL STOPS PIPE THREAD LEAKS

PAT. PENDING

Satisfaction Guaranteed Or Money Back TRIAL OFFER

TRU-O-SEAL Fittings are guaranteed to seal pipe thread connections permanently against all oils, practically all known chemicals and gases; to seal under high pressures or vacuum; to withstand —280° to plus 500° F.; to eliminate "overtightening" damage and pipe dope. Available in ⅛" to 2½" pipe thread sizes.

$10.00 Trial Offer No. 1: six ⅛", ten ¼", six ⅜", eight ½" pipe thread TRU-O-SEAL Fittings.

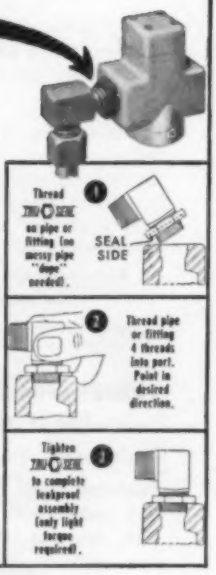
$10.00 Trial Offer No. 2: six ½", ten ¾", four 1" pipe thread TRU-O-SEAL Fittings.

Send order to

TRU-O-SEAL DIVISION Flick-Reedy Corporation

2008 N. Hawthorne, Melrose Park, Ill.

"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.


1 Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed).
SEAL SIDE
2 Thread pipe or fitting 4 threads into port. Point in desired direction.
3 Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).

Circle 53 on Reader Service Card

Circle 184 on Reader Service Card

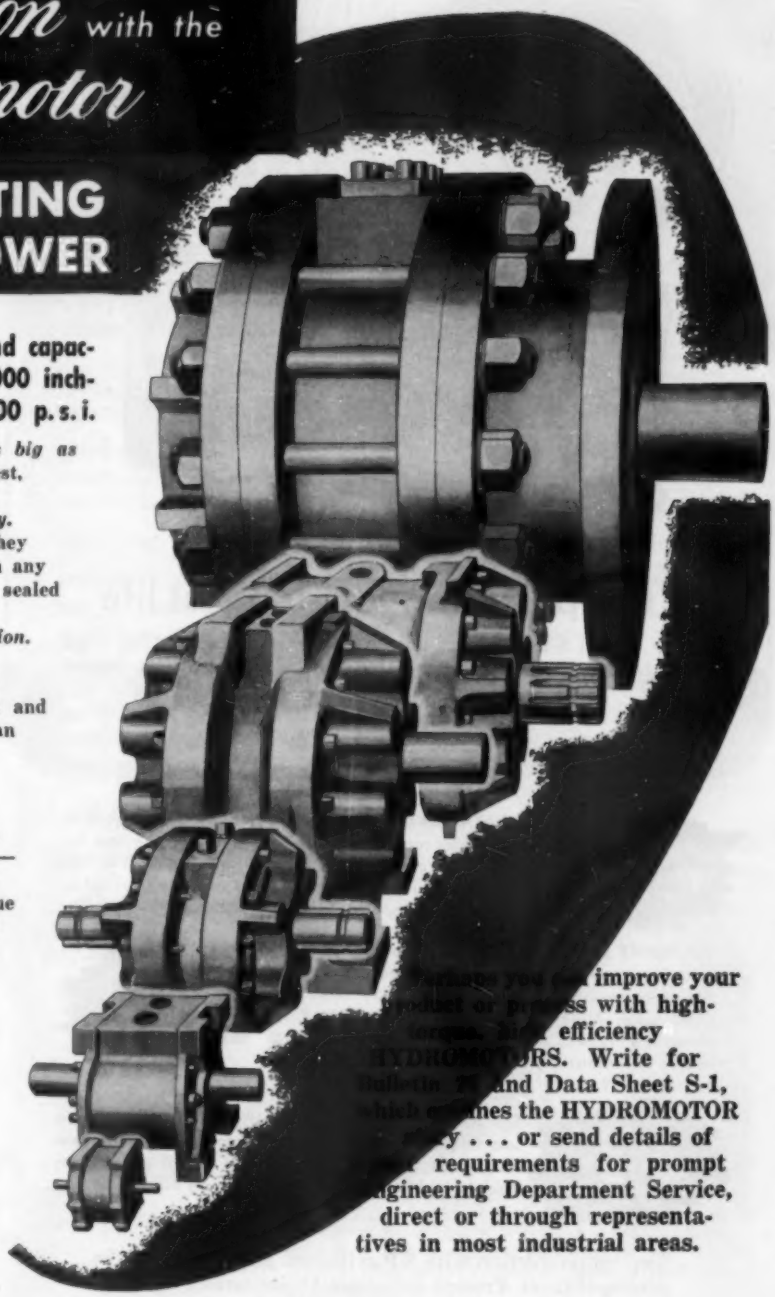
Automation with the *Hydromotor*

RECIPROCATING ROTARY POWER

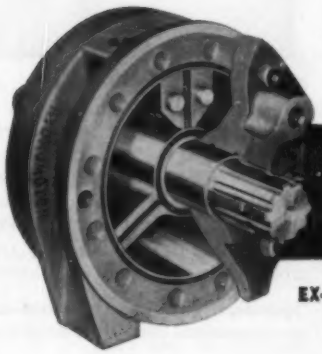
Wide choice of models and capacities from 150 to 1,000,000 inch-pounds of torque at 1000 p.s.i.

From the smallest *(only as big as your fist)* through the largest, HYDROMOTORS are *saving users time, space and money.* Compact and lightweight, they can be mounted anywhere, in any position and are completely sealed and self-contained to insure *dirt-free, trouble-free operation.* HYDROMOTORS eliminate expensive, bulky mechanical linkages, installation is fast and easy, maintenance is cut to an absolute minimum.

With HYDROMOTORS *reliable automation* can be achieved more simply. This reciprocating rotary actuator—operating with air, water or oil—develops instant full torque in either direction. Standard units travel 280° and develop 150 to 500,000 inch-pounds of torque. Double vane units—with maximum travel of 100°—approximately double the above torque values of the single vane unit IN THE SAME SIZE HOUSING. Special sizes are custom-built to individual specifications.



improve your ss with high- efficiency RS. Write for and Data Sheet S-1, mes the HYDROMOTOR y . . . or send details of requirements for prompt ngineering Department Service, direct or through representatives in most industrial areas.



Hydromotor DIVISION

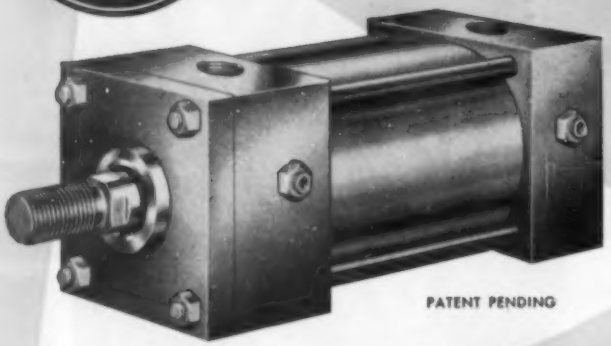
EX-CELL-O CORPORATION • CANTON 2, OHIO

LOWERING • REVOLVING
LIFTING • PUSHING • PULLING
SWINGING • OPENING
CLOSING • CLAMPING • TURNING
INDEXING • OSCILLATING, ETC.

Circle 97 on Reader Service Card

FOR AUTOMATION

SP CYLINDERS



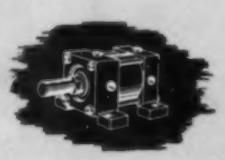
PATENT PENDING

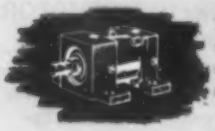
top performance–longest life

All S-P cylinders are engineered throughout for high speed, efficient operation. Piston rods are heat treated and hard chrome plated to resist scoring. Bronze cartridges with extra long bearing surfaces are easily removable for quick servicing of rod seals and wipers. End plates are rolled steel. All S-P cylinders are built to JIC standards.

S-P STANDARD AIR CYLINDERS have brass tubes to eliminate corrosion. Cushions float on O-rings for maximum cushioning. Eleven bore sizes, 1½" — 14". 21 mounting types. Readily modified for oil or water. Send for Catalog No. 110.

S-P HEAVY DUTY AIR CYLINDERS for automation and other severe applications. Double porting for extreme high speeds. Heavy wall seamless steel tube. Nine bore sizes, 1½" — 8". Five mounting types. Approved and used by two major automobile manufacturers. Send for Catalog No. 109-A.





S-P HIGH PRESSURE HYDRAULIC CYLINDERS have seamless steel tube. Special locking mechanism eliminates tie rods. Designed for 2,000 psi. Eleven models in 11 sizes. Send for Catalog No. 104.

Step up production with S-P cylinders. Representatives in principal cities. Prompt deliveries. Order catalog by number shown above. The S-P Manufacturing Corporation, 30201 Aurora Rd., Solon, Ohio. *In greater Cleveland.*

SPecify SP

THE S-P MANUFACTURING CORP.

SOLON, OHIO • *IN GREATER CLEVELAND*

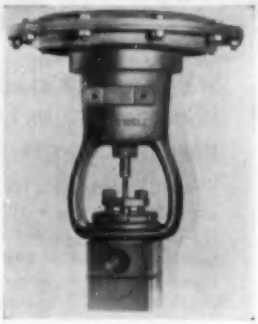
ESTABLISHED 1916 A BASSETT COMPANY

NON ROTATING AIR AND HYDRAULIC CYLINDERS • ROTATING AIR AND HYDRAULIC CYLINDERS POWER CHUCKS • COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES, ACCESSORIES

New Products continued

allow pressure drops as high as 6000 psi under flowing conditions. Units operate at temperatures from —40 to +400 degrees F. Wider temperature variations are available in special versions.

Specifications: Available in two models. Piston-operated throttling



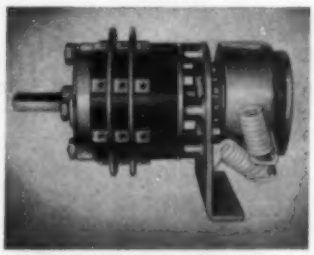
valve is 15-⅜ x 13-5/32 inches, and diaphragm-operated, 2-position valve is 10-½ x 11-⅜ inches. Valves have split-body construction with clamped-in seat ring, and are made of stainless steel. Also available in hand-operated models.

Minneapolis-Honeywell Regulator Co. Valve Division Philadelphia, Pa.

Circle 237 on Reader Service Card

ROTARY SWITCHES . . . are solenoid rotated

Designation: Types JR, HT & M-12



Operation: Solenoid rotating devices drive switch through cycle of contact positions. Indexing stroke of solenoid is matched to degree of rotation between contact positions of switch and drives rotor one position each time circuit is closed. Provides remote or semi-automatic control of series of complex circuits.

Specifications: Electrical load and environmental conditions determine

switch and solenoid combination used. Switches are custom-built to specifications. Type JR has 45-degree indexing, 8 contact positions up to 10 sections or poles and electrical rating 10 amp. 125 volts AC or 5 amp. 125 volts DC. Type HT has 22½-degree indexing and 16 contact positions up to 6 sections. Sub-miniature model M-12 features 30-degree indexing, 12 contact positions and up to 3 sections, at 3 amp. 115 volts AC.

Electro Switch Corporation
Weymouth, Mass.

Circle 238 on Reader Service Card

PRESSURE-VACUUM CONTROL

. . . is explosion proof

Designation: J95

Features: Designed for use in hazardous locations. Unit is uncalibrated and pressure settings are made by internal adjusting nut. Pressure assembly consists of bellows, load spring, spring tension adjustment and plunger. Load spring creates a force in opposition to movement of bellows. When pressure is applied, bellows expands moving plunger to operate

switch to open, close or transfer electrical current.

Specifications: Available with variety of ranges from zero to 500 psi and maximum pressure of 600 psi. On-off differentials between 2 and 30 psi are obtainable. Enclosure is cast iron, surface mounted, and bellows can be brass, monel or stainless steel. Control can be supplied with normally open, normally closed, or double-throw, no-neutral switch.

United Electric Controls Company
Watertown, Mass.

Circle 239 on Reader Service Card

Continued on next page

Circle 30 on Reader Service Card

NOW standardized . . .
PRECISION DRILLED
MANIFOLDS
and
Sub-Plates

MODEL
BHP-3002

Slash installation costs—Eliminate long cylinder lines—Give better cylinder action

Single feed manifold —shown with 4-way, flow and decelerating valves.

STANDARDIZED MANIFOLDS: Leak Proof, Solid Steel, Common tank, pressure and drain, All ports clearly marked, Mount near point of operation. These features give you lower cost installation and better performance.

SUB-PLATES: Side entering—All sizes to accommodate any standard hydraulic Valve.

SPECIAL DESIGNS: Our skilled craftsmen will design and manufacture Precision Drilled, Solid Steel, Leak Proof Manifolds to your specifications—Just send us a drawing of your circuit. We will give you a cost estimate. Write for catalog of standardized models.

BIRMINGHAM
Hydraulic Products Co.
14540 Schaefer Road
Detroit, Michigan
Phone BR. 3-8047

do you have a "tight seal" problem?

By tomorrow morning, this fella's problem will be solved, except for a headache. But if you have a problem with tight seals for metal-to-metal applications, it will take more than a good night's sleep—United's Metallic O-Rings, for example.

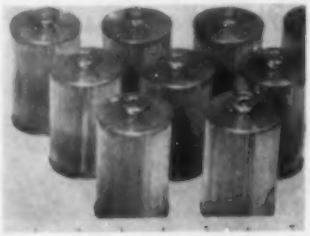
They fit any application calling for a positive, permanent seal against internal or vacuum pressures up to 10,000 p.s.i., in a temperature range from –70 to 1800°F. They are especially adaptable for sealing cylinder heads, air and hydraulic pressures, high octane fuels, vapors, gases, oils, solvents, chemicals, acids, vacuum and steam connections. Available in various metals and plating finishes, from 3/16" dia. to any size or configuration.

For free 22 page booklet describing United Metallic O-Rings, write (on your letterhead please) to Department H-2

UNITED METALLIC "O" RING CORP.
Dayton, Ohio • Box 1035
Division of United Aircraft Products, Inc.

New Products / continued

FILTER MEDIUM
. . . is rigid wire mesh



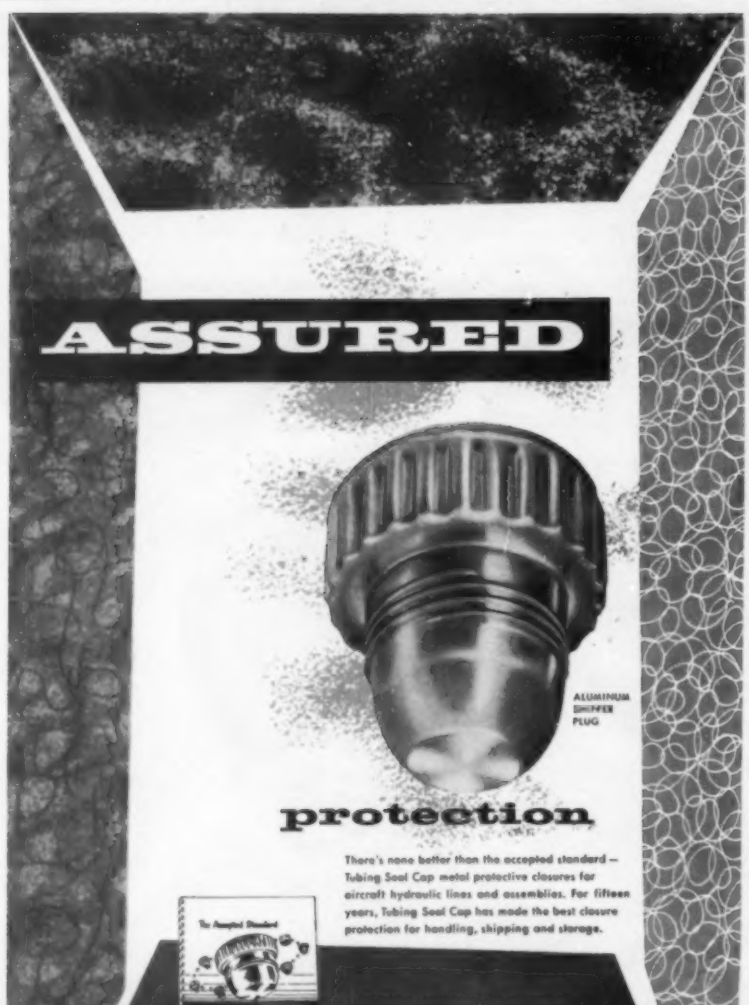
Designation: Rigimesh

Construction: Elements are made by furnace welding wires of the mesh at all contact points, providing accurate particle size rating. Layers of media can be bonded to form a laminate, giving good filtration with high mechanical strength. Filter elements are strong, lightweight, corrosion and temperature resistant, and reusable.

Specifications: Withstand operating temperatures from —65 to +900 degrees F, and pressures from vacuum to 10,000 psi. Particle size retention ratings: 2 to 2000 microns.

Aircraft Porous Media, Inc.
Pall Filtration Companies
Glen Cove., N. Y.

Circle 240 on Reader Service Card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ALUMINUM SHIPPER PLUG
protection
There's none better than the accepted standard — Tubing Seal Cap metal protective closures for aircraft hydraulic lines and assemblies. For fifteen years, Tubing Seal Cap has made the best closure protection for handling, shipping and storage.
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SEND TODAY for complete catalogue of sizes, styles and prices.
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808 West Santa Anita, San Gabriel, California
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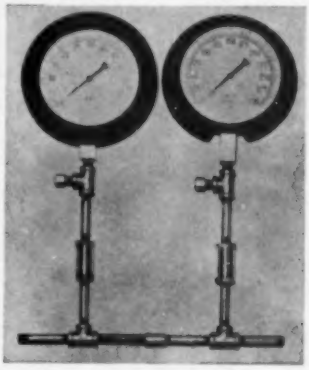
VALVES
. . . protect gauges

Design: Each gauge registers to the top of its range. When system pressure goes beyond range, relief valve in gauge circuit opens and check valve closes off system pressure. Gauge protection opens automatically when system pressure falls within range.

Features: Protection results from leak-proof sealing and accurate cracking of the valves. Check valve also closes automatically if Bourdon tube ruptures. System is protected against loss of liquid or gas,



personnel are not exposed to dangerous blasts and area around gauges is kept free of corrosive or combustible fluids in system or Gauge protection opens automatically when system pressure falls within range.

Circle Seal Products Co., Inc.
Pasadena, Calif.

Circle 241 on Reader Service Card

REUSABLE HOSE ENDS
. . . feature close coupling

Designation: Model H-69

Features: Units meet most requirements for pneumatic or hydraulic lines for original equipment or field installation. Designed for use

Continued on page 248

Circle 161 on Reader Service Card

PNEUMATICS SHEFFER HYDRAULICS

HYDRAULIC CYLINDERS

C4 H Series

- 2000-3000 psi
- All Steel Construction
- Meets or Exceeds J.I.C.
- 13 Bore Sizes—1½—12
- Removable Rod Cartridge
- Finest of the "Interchangeables"

Write for Bulletin #1256

THE SHEFFER CORP.

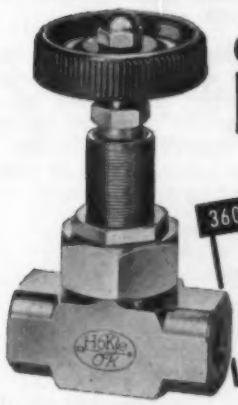
CINCINNATI 16, OHIO

MOST COMPLETE LINE OF CYLINDERS IN INDUSTRY

SOME TERRITORIES OPEN

HOKE announces

10 valves in 1



360 SERIES

High Pressure UNION BONNET GLOBE VALVE

For conditions ranging from 3000 psi to low vacuums, or distilled water to corrosive fluids. Series consists of four basic stainless steel bar stock valves... O-ring or Teflon packing with flat Teflon disc or vee point non-rotating, replaceable stem plug... plus six body styles. All parts interchangeable as well as replaceable. Choice of ⅛", ¼" or ½" pipe sizes or Swagelock tube fittings. Panel mounting, too. **Get the facts about this "10 in 1" valve. Write us today.**

HOKE

HOKE INCORPORATED

Fluid Control Specialists

187 S. Dean Street

Englewood, N. J.

ARROW

AUTOPNEUMATIC CONTROL

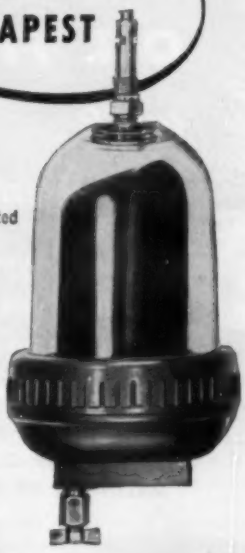
for Complete Conditioning and Control of Compressed Air for Powering Pneumatic Tools—Cylinders—Valves and Appliances.

PIPE LINE SIZES

¼"
⅜"
½"
¾"
1"

THE BEST IS CHEAPEST

AQUAMATIC DRAIN TRAP



- Automatically Drains Out Collected Moisture in Filter Bowl
- Visible Operation
- Non-Corrosive Parts
- Stainless Steel Valve
- Double Sump Action
- Valve Prevents Air Locks
- Adaptable to Any Make Filter with ⅛" NPT Drain Cock
- Can Be Connected to Floor Drain

QUALITY of PRODUCTS
SERVICE to CUSTOMER
RELIABILITY to INDUSTRY
Has been ARROW POLICY Since 1914

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Circle 208 on Reader Service Card

Circle 17 on Reader Service Card

New Products continued

with medium high pressure, cotton-covered, single wire braid hose. Compact design permits close coupling to conserve space. Threads match SAE and JIC standards, eliminating special adapters and complicated hookups.

Specifications: Available in following sizes: Inverted male thread, ¼ to ⅜-inch; female swivel, ¼ to 2-inch; rigid male pipe, ⅛ to 2-inch. Swivel nuts ¼, ⅜ and ½-inch connect to JIC 37° or SAE 45° fittings.

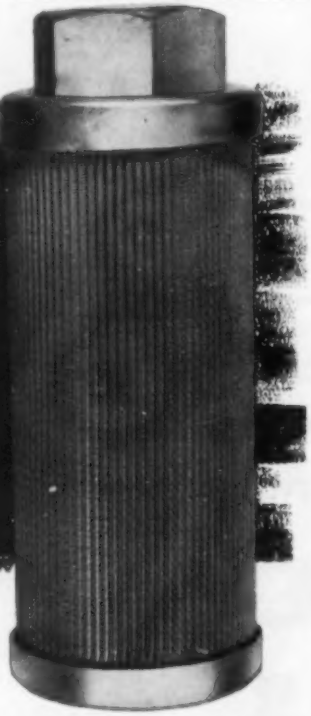
The Weatherhead Co.
Fort Wayne Division
Fort Wayne, Ind.

Circle 242 on Reader Service Card

Capital

HYDRAULIC OIL FILTER with Monel Metal Insert

Reservoir Type for Hydraulic and Oil Re-circulating Machinery



EASY TO INSTALL—EASY TO CLEAN
LONG LIFE—LOW COST—SIZES AND SCREENS TO FIT YOUR NEEDS

★ ONLY THREE PARTS
★ MEETS J.I.C. STANDARDS
★ GREATER FILTERING AREA
★ SPECIAL TRAP-WEAVE MESH

Specially woven MONEL wire cloth and a new method of compact corrugation, gives triple protection with less space than other filters of like capacity. Trap-weave mesh stops thin, elongated particles with NO loss of efficiency.

Non-corrosive, non-toxic materials throughout. Easily cleaned with an ordinary brush.

Write for descriptive circular.

CAPITAL ENGINEERING & MFG. CORP.

5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

ELECTRO-HYDRAULIC CONTROLS
. . . offer new uses

Designation: XRJ301A Amplifier and XVJ300A Valve

Design: Combines electronic signal sensing with hydraulic control of variable delivery pumps, motors and cylinders. Fully-transistorized amplifier receives signal inputs from standard 60-cycle AC source. Amplifier supplies driving power for 3-way servo valve, which controls flow to hydraulic linear or rotary motion drives. Single stage servo

valve is driven by torque motor, and is available in ratings up to 10 gpm and 3000 psi.

Features: Hydraulic power can be applied to applications previously using electric drives. Units also provide precision control of equipment now manually controlled. Output powers balanced single or split loads of as high as five watts.

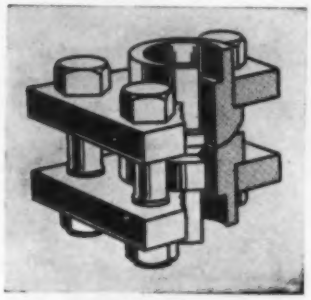
Minneapolis-Honeywell
Regulator Co.
Philadelphia, Pa.

Circle 243 on Reader Service Card

FLANGE UNION
. . . has socket weld construction

Features: Union will withstand operating pressures to 3000 psi with schedule 80 pipe, and 10,000 psi with special unions of same design. Fitting has true-ball seat for leak-proof sealing even with considerable misalignment of pipe. Revolvable flanges make assembly

Revolvable flanges make assembly easier as bolts and bolt holes are readily positioned. Union can be assembled many times and retain original sealing qualities.



Specifications: Available for pipe sizes ranging from ⅛ to 6-inches.

Almar Hydraulic Valve Company
Cleveland, Ohio

Circle 244 on Reader Service Card

5-MICRON FILTER
. . . uses white cellulose

Designation: Micro-Klean

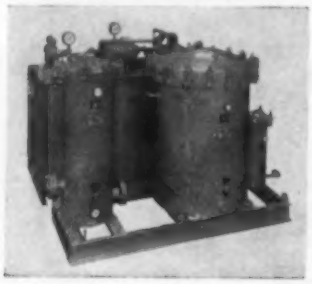
Features: Filter cartridge is made of white cellulose bonded with totally inert resin. Offers 5-micron filtration for hydraulic service and handles highly alkaline fluids without contamination of fluid or deterioration of cartridge. Unit fits most standard filter housings and features graded density construction.

The Cuno Engineering Corporation
Meriden, Conn.

Circle 245 on Reader Service Card

FILTER SYSTEM
. . . gives high capacity

Features: Flood lubrication and filter system has 1000 gallon capacity pumping unit designed to



deliver 80 gpm at 40 psi. Oil viscosity is 45 SSU at 100 degrees F., with foreign particles larger than 10 microns removed by filtration. Unit is equipped with pre-heating, timing cooling and thermostatic

Continued on next page

An important announcement in the aircraft field

AIRCRAFT HYDRAULIC DESIGN

by **GEORGE R. KELLER**
Group Leader,
Flight Control Engineering Dept.
Autonetics, A Division of
North American Aviation

George Keller is responsible for development, design, and testing of hydraulic systems and power servo-mechanisms for the flight control systems of missiles and inhabited aircraft.

He is particularly well known for his work in high temperature hydraulics and has written a number of papers on this subject. He is an active member of the aircraft committees of SAE and is a civilian consultant to the Office of Assistant Secretary of Defense.

Published by
APPLIED HYDRAULICS Magazine

- **The first book** dealing with hydraulic component and system design for high-speed piloted aircraft and missiles, AIRCRAFT HYDRAULIC DESIGN has been written by a leading aircraft engineer. Developed from practical and theoretical material, the book develops many basic equations including those relating pressure gradient, flow-path dimensions, flow rate, velocity, fluid density, and viscosity.

- **Design of system components** including actuators, valves, pumps, accumulators, transmission lines and seals is discussed. Accumulator theory is presented with a detailed example of proper accumulator selection.

- **Hydraulic servo systems** are diagrammed and the transfer functions developed. Fundamentals of transient analysis technique and frequency response method of servo testing are given. The chapter on high temperature hydraulics outlines present progress in fluids, seals, springs, metals, and other critical components, and indicates future developments and techniques.

The advance of industrial hydraulics in servo components and systems makes this book of great value to designers of industrial equipment as well as aircraft engineers.

$3.50

10 or more $3.00 per copy
Limited Edition

The Industrial Publishing Corporation
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Please send me ——— copies of AIRCRAFT HYDRAULIC DESIGN as soon as it is available (approximately March 1, 1957)

☐ Bill me (order no. ———) ☐ Money order attached

NAME .....

ADDRESS..... CITY..... STATE.....

New Products continued

devices to maintain constant temperatures automatically. Separate pump circulates 18 gpm continuously through a 5 micron Fullers Earth filter with capacity for 30 days service.

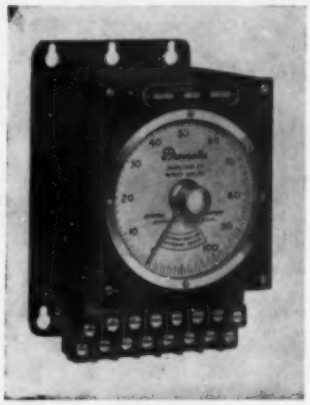
Cardwell Machine Co.
Richmond, Va.

Circle 246 on Reader Service Card

ELECTRONIC TIMER
. . . offers fast wiring changes

Designation: Types ET & ETH

Features: Matched housings are available for various mounting conditions. Front enclosure of Type ETH is split to permit access to terminals for fast wiring changes. Units have slide-out chassis, with plug-in tube and condenser. Timer will control operations between 60



milli-seconds and 60 seconds, adjusting to any fraction of this range. Units have readily accessible terminals, isolated load contacts and large, easy-to-read dial.

General Control Company
Boston, Mass.

Circle 247 on Reader Service Card

PRESSURE CONTROL BLOCK
. . . combines 3 components

Designation: Series EA-52008-A1

Features: Unit is compact, lightweight and designed for aircraft auxiliary drive systems to reduce starting torque, prevent stalling and purge air from the hydraulic system. Package consists of flow sensitive pressure regulator valve, system relief valve and check valve, all within a single housing. With three functions in one package, fewer fittings and less tubing are required. Reduction in external plumbing

minimizes possibility of leakage. Total package weight is about 2.5 pounds.

Specifications: Unit qualifies for use from —65 to 275 degrees F.

Continued on page 252

GOSHEN
O-RINGS

of proven synthetic and silicone rubber compounds
PRECISION MOLDED
to meet today's toughest sealing conditions
Goshen Rubber

QUALITY ENGINEERED RUBBER PRODUCTS

Write for your copy of O-RING BROCHURE . . . 12 pages of useful data on design, sizes, installation, and recommended practice. It's free on request.

If your problem is an O-Ring seal to deliver peak operating efficiency under the newer, tougher conditions of TODAY . . . put Goshen Rubber to work for you. Here, technicians and engineers, knowing the properties and characteristics of materials, processing methods and fabricating equipment, will gladly work with you in adapting to your application the correct GRC-O-Ring.

See our catalog in Sweet's product Design File.

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Circle 76 on Reade. Service Card

Circle 68 on Reader Service Card

INSTANT PRESSURE REGULATION

FROM 100 TO 3000 PSI

Proven Superior in Comparative Tests

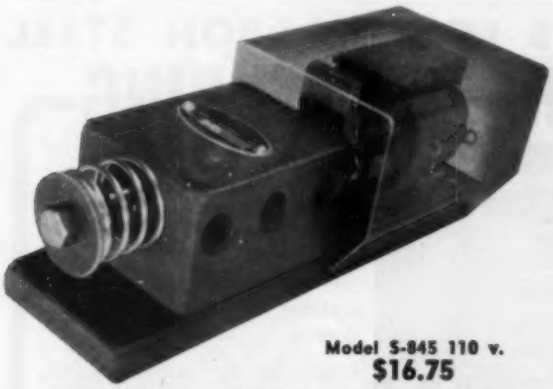
WITH THE **Futurecraft HI/LO HAND LOADER**

GENERAL SPECIFICATIONS	
Port Size	¼" tube per AND 10056
Pressures	Operating—100-3000 psi Proof—6000 psi Burst—7500 psi Minimum
Flow	Exceeds any other loader available
Operating Temperatures	— 65° to + 250°F
Weight	2⅓ pounds

Futurecraft CORPORATION

1717 N. Chico Ave. • El Monte, Calif.

***WRITE TODAY** for complete details*



Model S-845 110 v.
$16.75

BACHMAN 4-WAY 5 PORT VALVE

Stocked in ¼" and ⅛" sizes these powerful, direct acting valves can be energized continuously or intermittently up to 500 cycles per minute. The solenoid closes with force of 14 lbs against a spring loading of 8 lbs, yet destructive impact and noise are minimized by resilient plastic laminate construction and light weight alumilite spool

The model illustrated has 5/16" diameter orifice, ¼" pipe ports, is 8" long, and weighs 2 lbs. Inrush current, 4 amperes, holding 25 watts. Standard O-ring seals are used for pressures to 200 psi. Bachman valves are not sensitive to dirt or maladjustment and may be expected to give millions of cycles of dependable service. For immediate speed changes, positive dwell or cushioning action a Bachman 3-way, 3 port valve, installed either on the supply or exhaust side, will suggest many combinations for automatic control.

Write for the name of local distributor or order direct with our guarantee of satisfaction.

JOHN D. BACHMAN & COMPANY

1713 SPARGER LANE — BRISTOL, TENNESSEE

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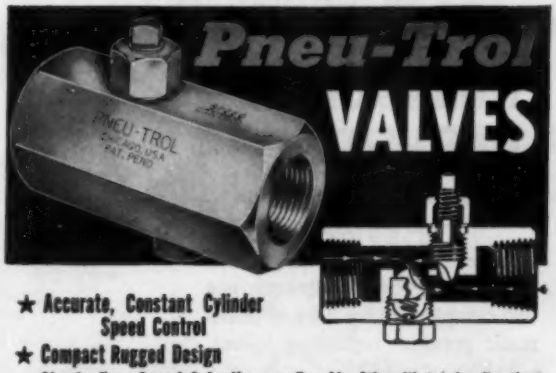
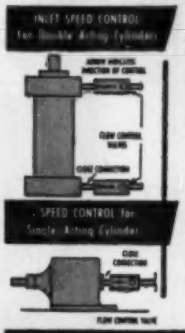
Circle 141 on Reader Service Card



★ Accurate, Constant Cylinder Speed Control
★ Compact Rugged Design
★ Simple, Easy Speed Selection ★ For Air, Oil or Water Applications



Pneu-Trol Speed Control Valves, are widely used in hundreds of control applications because they combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to its seat, requiring only a slight differential pressure to fully open or close it.

Needle design permits maximum flow capacity in the controlled direction. Metal to metal needle and ball seats insure long trouble-free service. Simple, practical "O" gland structure eliminates troublesome leaking. Valve bodies machined from hex brass or aluminum for 2000 psi working pressures; steel and stainless steel for 5000 psi. Made in 5 female pipe sizes—⅛" to ¾". ATTRACTIVE PRICES . . . IMMEDIATE DELIVERY.

Write for illustrated circular and prices.

Pneu-Trol DEVICES, INC.
1026 N. KEATING AVENUE • CHICAGO 51, ILL.

Atomuffler
Silences
NOISY BLASTS
of
AIR OPERATED EQUIPMENT
Extensive noise tests taken on pneumatic equipment prove conclusively that air exhaust noise hazards and annoyances can be definitely eliminated—by using ATOMUFFLER—without impeding mechanical performance of the equipment.
Today, industrial leaders agree that the control of these noises reduces work fatigue, improves production and increases individual efficiency.
ATOMUFFLERS effectiveness is endorsed by many outstanding manufacturers who specify and use ATOMUFFLER.
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COMPANY, INCORPORATED
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Circle 10 on Reader Service Card

precision

PRESSURE REGULATORS

14 models to meet almost all industrial needs

Send for catalog

Now available from the Stratos Industrial Products Branch are two complementary lines of pneumatic pressure regulating valves.

The pilot-operated GOVERNAIRE: very high flows are regulated by small signals in these self-contained, pilot operated models. Up to 250 psi supply pressure, pipe sizes from ¼ to ¾ NPT.

Drift-free, lever set model 3500

The direct acting KENDALL: also available in a wide flow range, these force-balanced types are designed for operation at up to 250 psi supply pressure. Pipe sizes from ¼ to ¾ NPT.

STRATOS

INDUSTRIAL PRODUCTS BRANCH

A division of Fairchild Engine and Airplane Corp.

Route 109, West Babylon, N. Y.

Circle 174 on Reader Service Card

New Products continued

Recommended nominal operating pressure is 3000 psi. Design permits mounting in any position. All connections conform to Specifications AND 10050-8.

Vickers Incorporated
Detroit, Mich.

Circle 248 on Reader Service Card

PANEL ENCLOSURES

. . . feature liquid-tight seal

Designation: NEMA 12

Features: No centerpost is used. Design utilizes all welded seams, with no holes. Offset doors are gasketed with Neoprene sponge and secured by locking handle with 3-point latch.

Specifications: Available in 8 sizes from 54 x 42 x 8 inches to 72 x 60 x 12 inches, in single or two-door models, with 12 inch floor mounting stand and lifting eye bolts.

Hoffman Engineering Corporation
Anoka, Minn.

Circle 249 on Reader Service Card

AIRCRAFT CONTROL SWITCH

. . . permits fast installation

Designation: H1-43

Features: Actuator arm can be adjusted infinitely through 14-degree arc and altered upon or after installation to meet requirements. Adjusting screw can be rotated to setting with one hand, permitting

SEAMLESS LOW CARBON STEEL

HYDRAULIC TUBING

Seamless, low carbon steel hydraulic tubing in standard outside diameters ranging from ⅛ —to—1½ inches is immediately available from our warehouse stock.

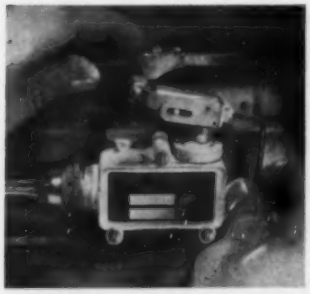
Hydrostatically tested to 1,000 psi, this tubing is manufactured in accordance with the Joint Industry Conference hydraulic standards. It is coated with a light rust preventative and ends are corked to protect the tubing during shipping and storage. Tubes are boxed for protection.

Call a Murray warehouse for prompt and efficient service for your tubing requirements. Send your inquiries to A. B. MURRAY CO. INC., 616 GREEN LANE, ELIZABETH, NEW JERSEY.
Write for current stock Bulletin

A B MURRAY CO INC
ESTABLISHED 1845
ELIZABETH, N. J. McKEESPORT, PA.
Bristol, Pa.

Circle 129 on Reader Service Card

constant check of operation with the other hand. Lock nut at rear of actuator fixes actuator position. Tipping action of actuator assures positive electrical control even when switch is ice-coated.



Specifications: Switch provides for standard 3-hole mounting and is a direct replacement for MS 25040 units. Sealed hermetically in inert gas, switch is protected against dirt or oil and is not affected by altitude changes, moisture and temperature cycling.

Electro-Snap Switch & Mfg. Co.
Chicago, Ill.

Circle 250 on Reader Service Card

4-WAY AIR VALVE
. . . has self-lapping seal

Design: Uses shear-seal principle of pressure-balanced, self-aligning tubular sealing ring contacting optically flat porting disc or rotor containing the flow passage.

Features: Positive shut-off is assured as flow is through the seal and square external corner of seal

wipes the rotor clean, preventing entry of dirt. Seals lap themselves with each actuation and the small amount lapped away after long service is taken up by a backup spring.

Specifications: Valves are available in 1½-inch size, for zero to 250

Continued on next page

Install "NEW" Valve

at Cost of:
2 O-Rings
2 Seat Seals
5 minutes labor

That's all it takes for easy TOP ENTRY "in-line" maintenance of Worcester's new TWIN SEAL BALL VALVE. To replace sealing components, simply remove the four bonnet bolts, and then the bonnet assembly. Ball and seat rings are easily lifted out by using hook in the hole provided in the stem slot. After cleaning seating surfaces in the body, replace ball and new seat rings as a unit. A new O-ring at the bonnet joint and around the stem will assure tight seals at these critical points. Result? . . . "factory tight" sealing tolerances in your long lasting Worcester TWIN SEAL Ball Valve . . . plus flexibility of seat selection to suit a great variety of media.

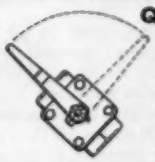
OTHER OUTSTANDING FEATURES

TWO-WAY FLOW

Two-way Flow . . . with positive shut-off . . . will hold nearly perfect vacuum. There is no danger of "wrong way" installation.

With opening in ball and seat rings maintaining same smooth shape as inside of pipe, resistance to flow is well below that of other valves and friction loss is reduced to a minimum.

QUICK OPERATION



The TWIN SEAL Valve goes from fully opened to fully closed position with only a quarter turn of handle and operator knows instantly position of ball and degree of closure. Valve adapts itself readily to remote control and mechanical operation.

FORGED CONSTRUCTION

Lack of porosity, closely held tolerances, absence of stress concentrations and the best possible material flow are some of the advantages of forged construction offered in Worcester's Twin Seal Ball Valve.

This valve is available in naval bronze and aluminum bronze. Seat material may be selected from Buna N, Neoprene, Natural Rubber, Teflon and Kel F allowing this valve to handle Water, Air, Propane, Oxygen, Chemicals and a great variety of other media.

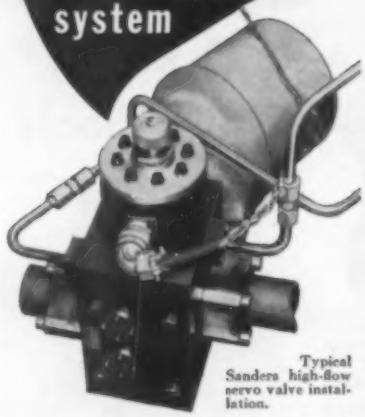
Ball
Gate
Needle
Valves

Write for full particulars

WORCESTER VALVE CO., INC.

16 PARKER ST. • WORCESTER, MASS.

Reliability for the heart of your electro-hydraulic servo control system



Typical Sanders high-flow servo valve installation.

In the development of automatic control systems involving position, velocity or force, Sanders Associates maintains a completely equipped electro-mechanical and hydraulic laboratory devoted to systems engineering.

The hearts of these systems are the various Boot-Strap* electro-hydraulic servo valves designed and built by Sanders. From the largest (0-400 GPM) to the smallest (0-1 GPM), these valves can be integrated into any complete system requiring high frequency response, reliability and simplified operation.

For both industrial and military application, Sanders electro-hydraulic control systems have a record for reliable performance under extreme environmental conditions. If you are seeking maximum efficiency for similar systems, Sanders engineers are glad to contribute their experience to your needs. Simply write to Dept. AH-1.

Vital control functions performed by Sanders Electro-Hydraulic Servo Valves

- Aircraft and missile control systems.
- Atomic-powered submarine steering and diving systems.
- Anti-aircraft gun systems.
- Aircraft test facility systems.
- Rocket and jet engine fuel control systems.
- Widely varied process control systems.

*T. M. Sanders Associates

SANDERS ASSOCIATES INCORPORATED
NASHUA, NEW HAMPSHIRE

New Products continued

psi service. Non-corrosive materials are used for all valve parts.

Barksdale Valves
Los Angeles, Calif.

Circle 251 on Reader Service Card

"B" SEAL
. . . snaps on flange

Features: High temperature, high pressure seal has lip design which snaps on the flange for fast, positive alignment. Unit may be assembled by touch in tight places.

Seal is used with conventional flanges and with 3 types of couplings: threaded standard V-band; and articulated. Forms a compact, light weight, low-cost joint.

Specifications: Successfully tested for 1000 psi at 1000 degrees F. on small sizes. Available in any size.

Awica Products, Inc.
Los Angeles, Calif.

Circle 252 on Reader Service Card

CLAMP-TYPE HOSE END
. . . provides versatility

Features: Couples readily on high pressure air or hydraulic lines and meets most requirements for original equipment or field replacement. Easily installed requires no hose skiving or special tools; and may be reused.

Specifications: Available in sizes from ¼ to 2-inch in malleable

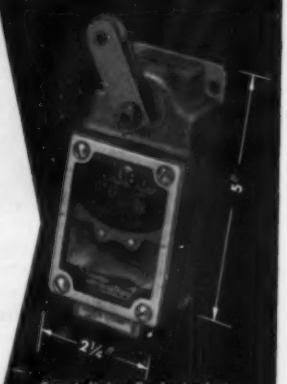
Continued on page 256

Why leading manufacturers are "SWITCHING" WITH DENISON LOXSWITCH

HEAVY DUTY LIMIT SWITCHES

Operates Over 1 Year Under A Constant Flush of Coolant!

On a group of machines in an automotive plant Loxswitch limit switches are still operating after a year under a constant flush of coolant (previous switches failed in less than a week). When manufacturers hear of a machine tool limit switch that gives results like this—at no increase in price—it's only natural that they change to Loxswitch. Obtain these same amazing results. Write or phone for a copy of Catalog 956.



LOXSWITCH Pronounced lockswitch is a registered trade mark for limit switches.

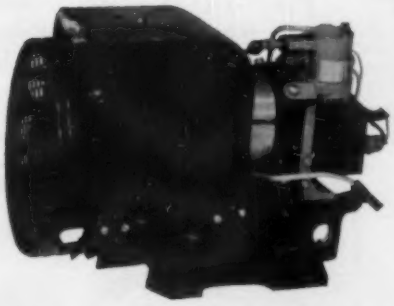
Specializing Exclusively in the Manufacture of Limit Switches.

R. B. DENISON MFG. COMPANY
102 ST. CLAIR AVE. N.W. • CLEVELAND 13, OHIO

Circle 155 on Reader Service Card

Circle 52 on Reader Service Card

On the new F-27... a complete pneumatic system!



Another off-the-shelf item – Kidde 2 cfm AC-driven compressor package including moisture separator, relief valve, pressure switch and inlet pressure regulating device.

Designed and built by Kidde engineers to Fairchild's exacting specifications, the Kidde pneumatic system saves approximately 100 pounds, is faster operating, is easier to maintain, and requires no flammable liquids.

Matching the smoothness of her Rolls-Royce prop jet engines, pneumatic power for the F-27 is furnished by two engine gear box driven Kidde 2 cfm air compressors. The air stored at 3300 psi is used for operation of nose wheel steering, wheel brakes and anti-skid system, landing gear, up locks, propeller brakes, tail bumper and emergency systems.

Design responsibility for the F-27 pneumatic system rests with Walter Kidde & Company, who can furnish complete pneumatic systems on an off-the-shelf basis, as well as the engineering talent to develop and produce special equipment on request. Get the answers to your pneumatics problems now ... by writing Kidde today.

Kidde

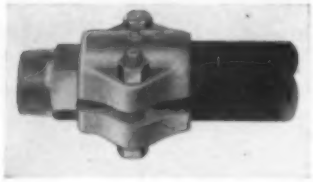
The words 'Kidde', 'Lux', 'Inflatair' and the Kidde seal are trademarks of Walter Kidde & Company, Inc. and its associated companies.

Walter Kidde & Company, Inc.
116 Main St., Belleville 9, N. J.
Walter Kidde & Company of Canada Ltd., Montreal

District Sales-Engineering Offices: Washington, D. C.; Dayton, Ohio; Dallas, Tex.; Seattle, Wash.; St. Louis, Mo.; Van Nuys, Calif.; Montreal, Canada; Belleville, N. J.

Circle 209 on Reader Service Card

New Products continued



iron, cadmium plated. Clamp halves match accurately and bolt head hex-shaped recess eliminates need for two wrenches. Insert prevents restriction of hose I. D.

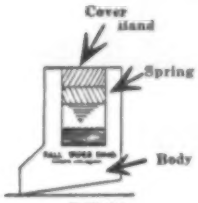
The Weatherhead Co.
Fort Wayne Division
Fort Wayne, Ind.

Circle 253 on Reader Service Card

Fall —the original

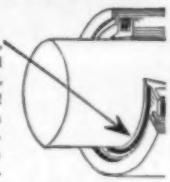
SPRING LOADED
Wiper **Ring**

***WITH* SQUEEZE GRIP ACTION**



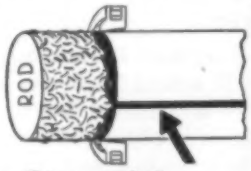
FWR-3C
3 Piece Type
Spec. MIL-S-5049, AN approved. Ring consists of 3 pieces assembled into one

Wiper Edge Is Tight Against the Rod at All times regardless of wear—



Cuts through Ice, Stops Build Up of Ice, Mud and other foreign bodies between rod and ring. You can depend on the FALL Wiper Ring because it IS Spring Loaded! Its spring maintains a squeeze grip action on the wiper edge of the ring at all times preventing ring from ever opening up. Rods never stick or become immobile in ANY temperature because uniform tension of spring is always the same under the endless cover band. Squeeze grip action is constant, uniform and complete around entire circumference of rod. The U. S. Army & Navy have used the 3 piece Fall Wiper Ring (FWR-3C) since 1944. Military part numbers from AN6231A1 ½" to AN6231A71 13" diameter.

Stop This Dirt Streak at the Ring Joint with the "CJ" Closed Joint



Fall *Wiper* Ring SPRING LOADED

Fall Industrial Wiper Rings have a "closed joint" therefore contact the complete O.D. of piston rod and do a better job of "wiping" or "scraping" off ice, dirt, and other stubborn-to-remove-hardened-obstacles which adhere to rod. When needed, we add certain of our "rubber seal" features which, combined with metal ring, "seals out" dust and sand thus preventing passage around ring—and with another of our "rubber seal" features added "seals out" liquids thus preventing passage through ring.

Our engineers will gladly work with you on any wiper ring problem. Write, wire or phone us.

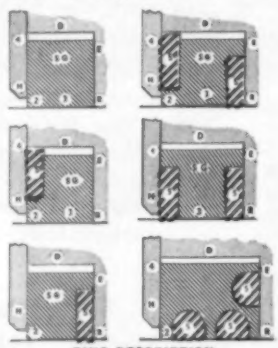
All FALL Wiper rings are covered by patents issued or patents pending.

ACE PRODUCTS CO. Toledo 1, Ohio, Phone CH3-6513

You Can Depend on ACE PRODUCTS

— Established 1935 —

Showing 6 of the many FALL "Closed Joint" Wiper Rings for Industrial Hydraulic and Air Use with "Squeeze Grip Action" on the piston rod.

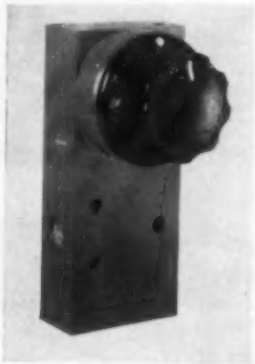


RING DESCRIPTION
SG—"Squeeze Grip."
2—Front side of ring.
3—Closed Joint is in ring.
4—Flange (or plate) holds ring in cavity.
5—Rubber seal compressed in restricted area.
H—Inside dia. of flange at bevel end (see #4 above).
D—Depth of Cavity for holding ring.
E—I.D. of cavity for holding ring.
R—Ring I.D. and/or rod O.D.

SOLENOID PILOT VALVES
. . . give fast response

Designation: Types HPV7/11, LPV7/11, ELPV7/11

Features: Designed for air or hydraulic service, valves are glandless poppet type. Solenoids use DC current and no chattering or overheating is experienced. Speed of response is very high and units can operate at frequencies in excess of 600 cycles per minute for any desired period.



Specifications: Model HPV7/11 has 1/16-inch bore, operates at 250 psi. LPV7/11 with ⅛-inch bore uses 80 psi. ELPV7/11 has 3/16-inch bore and handles 15 psi.

Pneumatics Division
Baldwin Instrument Company Limited
Dartford, England

Circle 254 on Reader Service Card

FLANGE-TYPE CONNECTION
. . . features quick assembly

Features: Flanged fitting provides quick, convenient means of connecting flared tubing to hydraulic equipment. Equipment manufacturers can adapt this fitting by designing a simple pad on the body

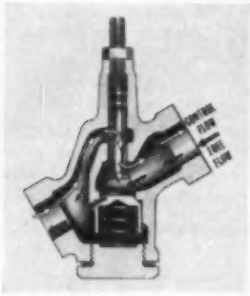
of the equipment to receive the flange. Connection is available with a variety of gasket materials to suit requirements.

W-S Fittings Division
H. K. Porter Company, Inc.
Roselle, N. J.

Circle 255 on Reader Service Card

SPEED CONTROL VALVE
. . . has slot adjustment

Features: Designed for ease of adjustment and maintenance, the poppet is the only moving part.



Valve can be mounted in any position, at either or both ends of a cylinder, to provide split-second control of piston movement. Unit can be disassembled easily without breaking the line connection.

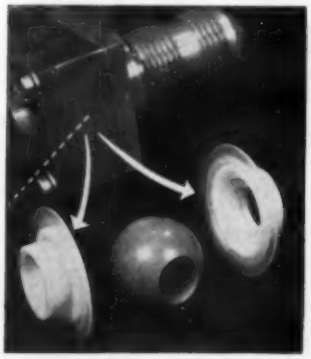
Specifications: Valve is available with screwdriver slot, knob, or pin lever adjustment

Ross Operating Valve Co.
Detroit, Mich.

Circle 256 on Reader Service Card

BALL VALVE SEALS
. . . molded from Teflon

Features: Exclusive process permits molding of Teflon seals in thin sections and shapes with close tolerances. Seals withstood tempera-



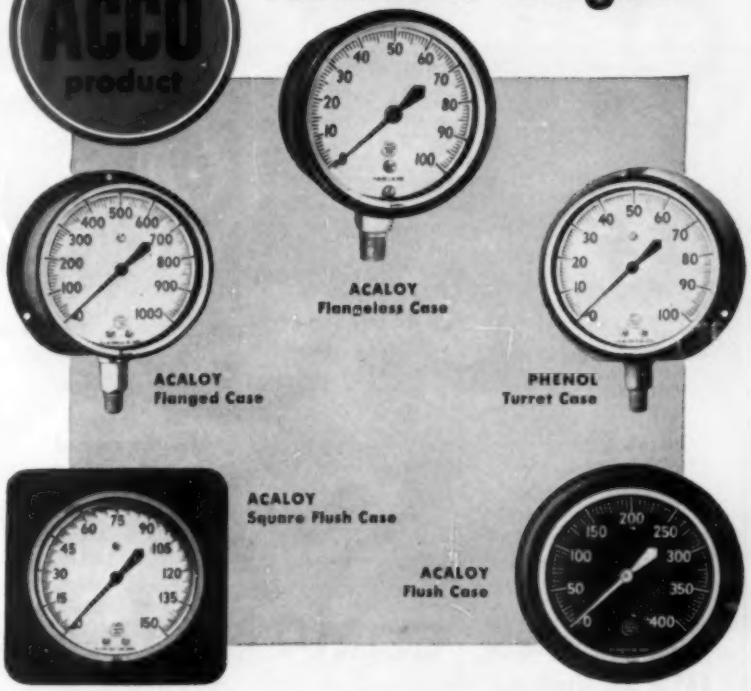
ture range from —65 to 350 degrees F and pressures as high as 350 psi. Process of custom molding prevents waste of material when machining Teflon.

Sparta Manufacturing Company Division
United States Ceramic Tile Company
Dayton, Ohio

Circle 257 on Reader Service Card

an ACCO product

Helicoid Gages



No Gears! No Teeth!

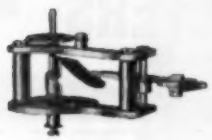
The gage of enduring accuracy

HELICOID Gages—without gears or teeth—last longer in rugged gage service because they eliminate the major sources of gage trouble. There can be no wearing and fouling of teeth or excessive play between teeth because there are no gears, no teeth in HELICOID Gages.

No expense has been spared in extensive research, engineering and testing equipment to produce this outstanding pressure instrument—a gage of the utmost precision and enduring accuracy.

HELICOID Gages are available for practically every type of installation and service—in many sizes and many styles—for pressure, vacuum or compound service. Furnished in a full range of pressures; all with the HELICOID stainless steel movement.

Write today for the HELICOID Gage Catalog



1 Stainless Steel HELICOID Roller (no gear teeth).
2 Stainless Steel Hair Spring.
3 Long Life Cam (no gear teeth).
4 Corrosion-resistant Link and Screws.

ACCO

Helicoid Gage Division
AMERICAN CHAIN & CABLE

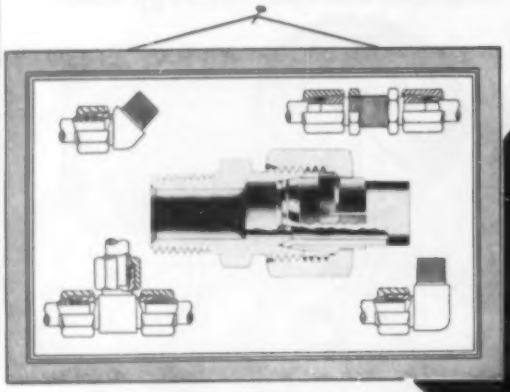
929-H Connecticut Avenue • Bridgeport 2, Connecticut

for Better Value

Circle 87 on Reader Service Card

Circle 63 on Reader Service Card

WE'RE IN THE PICTURE



FLODAR FITTINGS in every style, size and shape

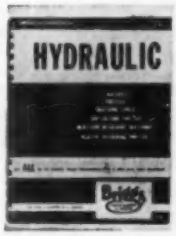
Here's a complete line of Flodar *Engineered Fittings* for assured performance. Self-flaring, No-Flare, Flare type and O-Ring Straight Thread—from 1/8 to 2" o.d.—to fit every installation picture. For dependable, leak-proof performance at high pressures, insist on Flodar Fittings.
Warehouse stocks in all principal cities.

Write for our New Catalogs

FLODAR CORPORATION
16911 St. Clair Avenue Cleveland 10, Ohio

BRIGGS OFFERS YOU, FREE, A 12 PAGE MANUAL ON HYDRAULIC FLUID CIRCUITS AND HYDRAULIC OIL FILTRATION

HERE is a big 8½" x 11", file size, 12 page, fully illustrated booklet. It's brimful of technical data and drawings that every designer and engineer will want to read or keep for ready reference. Write for your copy. No obligation.



Briggs PIONEERS IN MODERN OIL FILTRATION

HYDRAULIC OIL FILTERS

MAIL COUPON NOW

THE BRIGGS FILTRATION COMPANY
DEPT. 144—WASHINGTON 16, D. C.

YES! AT NO COST or obligation, send me the above booklet.

Name .....
Company .....
Address .....

Useful Literature / continued

CLUSTER FITTINGS . . . for aircraft applications are covered in 44-page booklet "Aircraft Piping and Engineering Application Manual" released by The Weatherhead Company. Booklet discusses use of cluster fittings to reduce piping congestion and fluid leakage failures in modern aircraft. Data is given on planning, selection and installation of various aircraft piping systems.

Circle 284 on Reader Service Card

PRESSURE GAUGES . . . produced by Norden-Ketay Corporation's Instrument and Systems Division feature transmission of linear motion without gears. Bandrive movement utilizes long-deflection constant-force spring. Gauges are made to ASME standards and are inter-changeable with older type gages.

Circle 285 on Reader Service Card

TUBE FITTINGS . . . for pneumatic or hydraulic applications are described in Bulletin 3061 released by The Imperial Brass Manufacturing Company. Foolproof butt joint assembly with 3 precision components is described and illustrated. Complete specifications on the various fittings are given, along with a table of maximum working pressures for type of tubing material and wall thickness.

Circle 286 on Reader Service Card

AIR AND OIL CYLINDERS . . . with prestressed snap rings, are illustrated and described in a bulletin offered by Densmore Engineering Co., Inc. Bore sizes 2 to 4 inches, hydraulic cylinders designed for any stroke up to 18 feet. Standard hydraulic cylinders designed for maximum working pressure of 1500 psi.

Circle 287 on Reader Service Card

FORCE METER . . . using proportional hydraulic pressure, is produced by Charles W. Schneible Company. Measurement of any mechanical load, force or thrust is accomplished by converting mechanical force to proportional hydraulic pressure through use of diaphragm-type assembly. Heavy loads may be determined without involving excessive pressure and small loads

Continued on page 261

Circle 172 on Reader Service Card

If your equipment or process requires . . .

ACCURATE, AUTOMATIC TEMPERATURE CONTROL

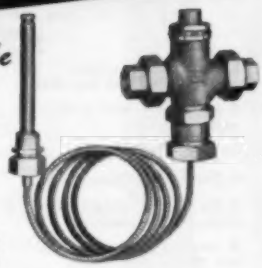
for HEATING or COOLING (using STEAM, WATER, or HEAT TRANSFER FLUIDS)

There is no equal to the

Sterlco®

Series 150-E

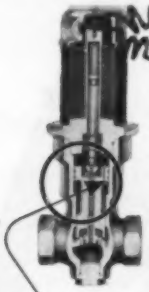
TEMPERATURE CONTROL VALVE



Here is a quality, dependable, and low cost self-actuated automatic modulating control valve. It's compact, self-contained; and, as part of your equipment or process, will eliminate the human factor of manual valves. Balanced single-seated construction eliminates effect of pressure variation. Send for Bulletin #505.

MOUNTS *and* OPERATES *in* ANY POSITION

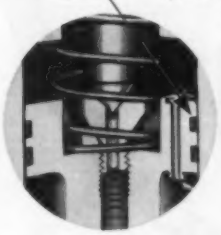
INDUSTRIAL CONTROL DIVISION
STERLING, INC.
3742 N. Holton Street • Milwaukee 12, Wis.



Atkomatic

stick-free
SOLENOID VALVES

end valve binding
at extreme temperatures



Unbreakable piston rings provide "free-floating" piston action.

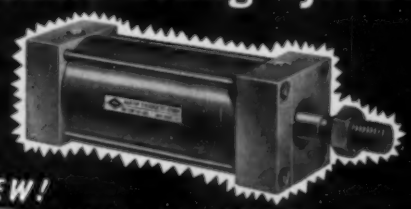
No valve binding—even at 450° F above zero, or 300° F below—when you specify Atkomatic! Atkomatic's unbreakable piston rings compensate for expansion and contraction through extremes of hot and cold. They assure free-floating piston action, keep valve body walls free of deposits. This means less wear and longer valve life.

Atkomatic offers a complete line of 2-way valves for automatic control of liquids, air, gas and steam. Bronze or stainless steel. Pressures: 0 to 5000 psi. Packless, full ported, leak proof.

write for FREE 20 page catalog 200-A

ATKOMATIC VALVE CO., INC. Dept. 3A
545 West Abbott Street, Indianapolis, Indiana

Now...a truly low cost* double-acting cylinder



NEW!

Cylinder is also available with Alkon's exclusive elliptically ground piston rod. Non-rotating, it holds register *without* external guide ways!

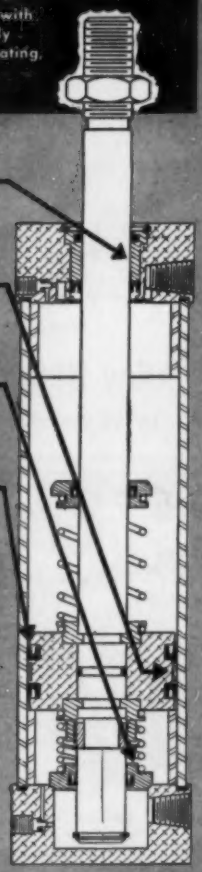
1. OILITE CARTRIDGE type piston rod bearings—with 1 x 1 surface area and piston rod wiper.

2. NO METAL-TO-METAL CONTACT—tough nylon bearing mounted on large surface piston prolongs cylinder life.

3. UNIQUE CUSHION ARRANGEMENT—assures positive cushioning. Three types: 1" long, standard or adjustable; extra long cushions up to 6".

4. SELF ADJUSTING neoprene packings throughout; their block-vee design yields negligible friction.

5. THREE WAY flush rabbet mountings—front, rear, and horizontal are standard at no extra cost.



Operates on 250 psi (air), 500 psi (water or oil). Exceeds JIC standards.

COMPONENTS: Seamless steel, chrome plated, roller burnished barrel. High tensile heat-treated extruded aluminum heads. Stainless steel, hardened, ground and polished piston rods.

AVAILABLE FROM STOCK: Double and single acting cylinders, double-ended piston rod cylinders—cushioned or non-cushioned. Interchangeable mountings—foot, flange, swivel, pivot, rod clevis, (OEM specials). Write for free catalog.

Rustproof throughout

COMPARE THESE PRICES!

size bore	flush mounts model	flush mounts price	per inch of stroke	adjustable front or rear cushion
1¼	12	15.00	.50	6.20
1¾	24	19.00	.60	6.50
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3½	96	36.00	1.00	8.35
4½	160	49.00	1.35	9.00

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ALKON PRODUCTS CORP.
200 Central Ave., Hawthorne, N. J.

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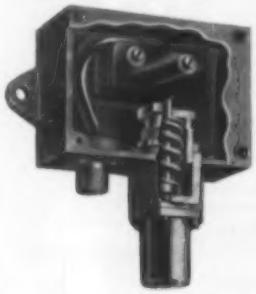
NEW! Hydraulic and Pneumatic BONDEE PRESSURE SWITCH

With the PATENTED PRESSURE ELEMENT



Light Weight—Heavy Duty

1-OPERATES FROM 0 to 1200 PSI with over pressure as high as 3000 psi —will not distort pressure element.

2-ADJUSTABLE OVER ENTIRE RANGE from 0 to 1200 psi. Repeats accurately every time.

3-ADJUSTMENTS MADE EASILY without interfering with the pressure element.

TOTALLY ENCLOSED and TAMPERPROOF

Weather resistant cast aluminum alloy or stainless steel available. Arranged for wall or bracket mounting in any position. Uses any MICRO SWITCH, 15 amps, 120 to 460 volts, AC., with single pole double throw silver contacts. Also available for D.C. Applications.

Write for descriptive literature

Alloy Bellows Engineering Co.

18125 Roseland Rd., Cleveland 12, Ohio

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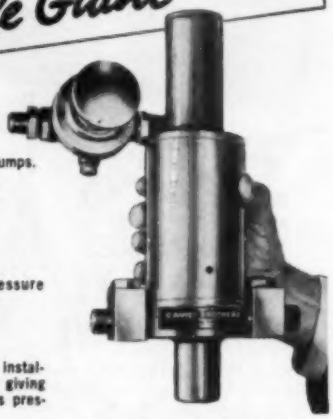
8 reasons why you should switch to—

AIR-HYDRO-PUMP Jr. *"The Little Giant"* FOR PRESSURE TESTING 10,000 PSI (with air-100 psi)



1. Operates more quickly and efficiently than hand pumps.
2. A turn of the wrist gives instant pressure.
3. Saves man hours.
4. Eliminates fatigue.
5. Maintains constant pressure without air consumption.
6. Ideal for testing valves and fittings.
7. Economical for multiple installation at test points, thus giving wide range of simultaneous pressures.
8. Ideal as source of hydraulic power for operating small presses, jacks, rams, clamping devices and other hydraulic mechanisms.

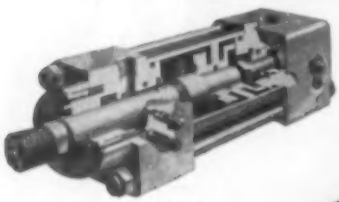
SIX JUNIOR MODELS
100 PSI TO 10,000 PSI
$185.00
F.O.B., N.Y.C.

Also Complete Range of 35 Standard Models, Single or Double Acting

DAVIES BROS. 120 WALL ST., N.Y. 5, N.Y.

PETCH CYLINDERS

meet J.I.C. & NC-1 STANDARDS *providing* "MOTOVATION for AUTOMATION"



☐ TIE-ROD Design
Low Pressure Hydraulic 500 psi—1½"-10" bores; High Pressure Hydraulic 1500 psi 1½"-6" bores; Air 200 psi—1½"-10" bores

☐ AUTOMOTIVE heavy duty AIR 200 psi—1½"-6" bores

☐ BOOSTERS
Drive Cylinders 4", 5", 6", 8" bores Ratios 5:1 to 28.5:1

☐ TANKS
4"-10" bore sizes

Petch Hydraulic Devices include:

☐ HUPP Threadless Sub-Plates—Inserts & Swivel Fittings
☐ Limit Switch Actuator
☐ Oil Tank Sight Gauge

Send for catalog regarding the product or products for which you have use—each one includes complete specifications and engineering data. The complete PETCH portfolio consists of 96 pages of hydraulic and pneumatic information.

PETCH PMC **MANUFACTURING COMPANY**

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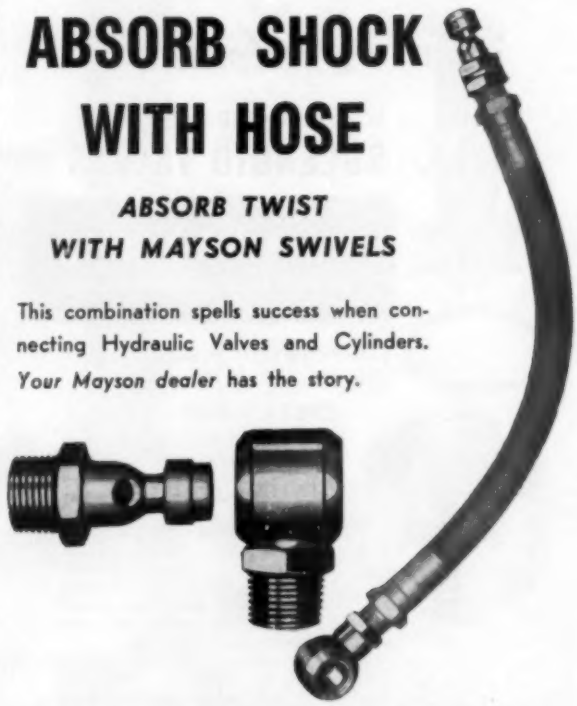
ABSORB SHOCK WITH HOSE

ABSORB TWIST
WITH MAYSON SWIVELS

This combination spells success when connecting Hydraulic Valves and Cylinders. *Your Mayson dealer* has the story.



MAYSON MFG. CO.

4332 HORATIO STREET • DETROIT 10, MICH.

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Circle 117 on Reader Service Card

Useful Literature / continued

without measuring very low pressure. Bulletin F1 gives complete details on the ForcOmeter.

Circle 288 on Reader Service Card

AIR LINE FILTER . . . for removing moisture and oil vapors from air stream, is manufactured by Hankison Corporation. Designed for small volumes of compressed air, protecting delicate instruments from contamination in air supply. Dew points of —67 degrees are obtainable. Rated from 1 SCFM at 100 psi, 70 degrees F to 25 SCFM at 6000 psi. Bulletin 302 gives details and specifications.

Circle 289 on Reader Service Card

AIRCRAFT SWITCHES . . . manufactured by Minneapolis-Honeywell Regulator Company's Micro Switch division, are described in 24-page catalog 77. Over 70 different snap-action, enclosed switches are covered, including environment-proof, hermetically

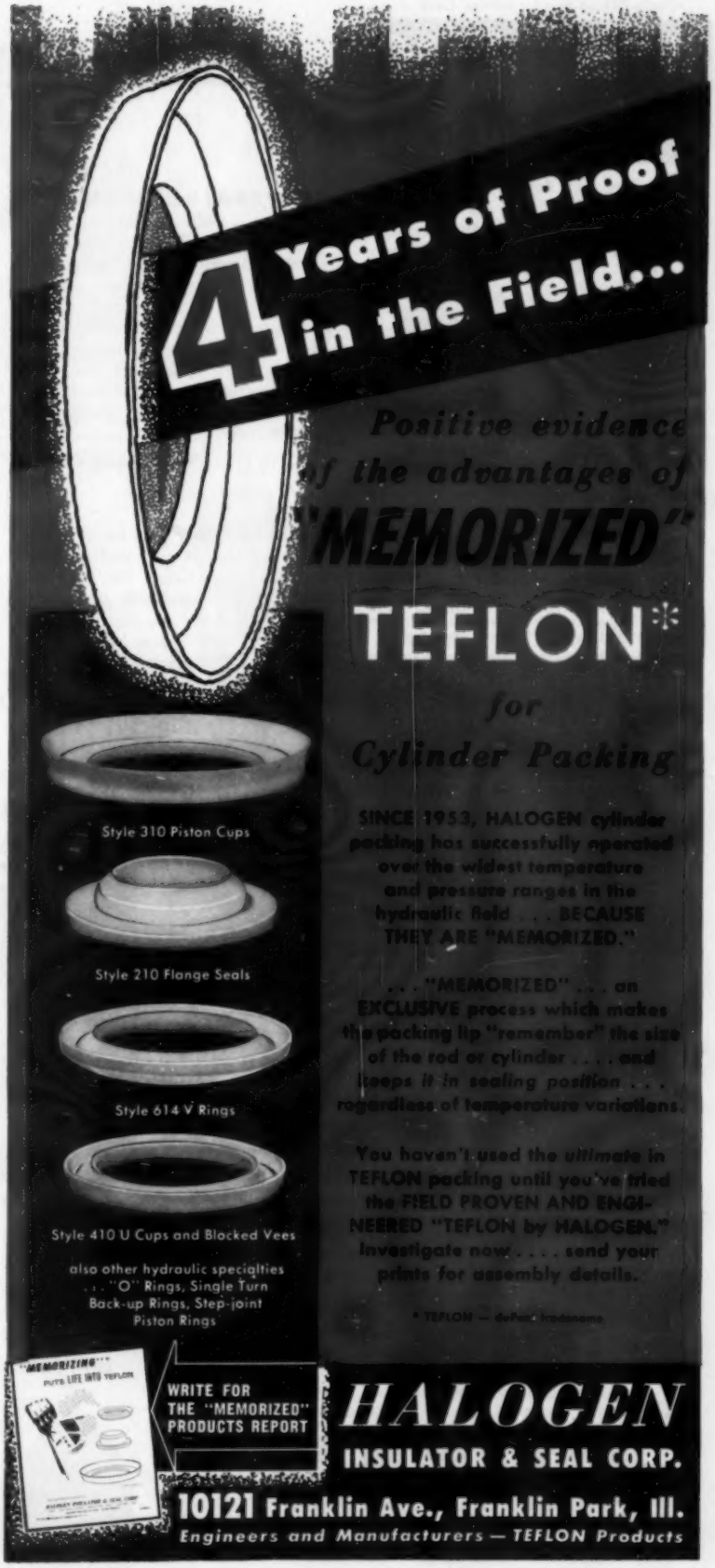
sealed and enclosed multi-circuit models, and switches which are JAN, AN and/or MS approved. Descriptions are complete with photographs, dimensional drawings, electrical ratings and technical information.

Circle 290 on Reader Service Card

STRAIN GAUGES . . . for a wide variety of applications, are manufactured by Baldwin-Lima-Hamilton Corporation's Testing Equipment Department. Bulletin 4452 discusses the selection of gauges, gives typical circuits and covers instrumentation or recording devices required. Bulletin 4453 deals with application of strain guages, using cartoon-type illustrations.

Circle 291 on Reader Service Card

Continued on next page


4 Years of Proof in the Field...
Positive evidence of the advantages of
"MEMORIZED"
TEFLON*
for
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Style 310 Piston Cups
Style 210 Flange Seals
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also other hydraulic specialties . . . "O" Rings, Single Turn Back-up Rings, Step-joint Piston Rings
SINCE 1953, HALOGEN cylinder packing has successfully operated over the widest temperature and pressure ranges in the hydraulic field . . . BECAUSE THEY ARE "MEMORIZED."
. . . "MEMORIZED" . . . an EXCLUSIVE process which makes the packing lip "remember" the size of the rod or cylinder . . . . and keeps it in sealing position . . . regardless of temperature variations.
You haven't used the ultimate in TEFLON packing until you've tried the FIELD PROVEN AND ENGINEERED "TEFLON by HALOGEN." Investigate now . . . . send your prints for assembly details.
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Engineers and Manufacturers — TEFLON Products

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HYDRAULIC Piston Pumps

Two and Four Cylinder

- PUSH
- PULL
- LIFT

Positive Displacement
2500 P.S.I.

INQUIRIES INVITED

from
O.E.M. Manufacturers

Over 15,000 units in successful operation in a wide range of applications. Original equipment manufacturers are invited to write for descriptive literature and prices.

WILLIAMS MACHINE and TOOL COMPANY
2802 N. 24th St., Omaha 10, Nebr.

Useful Literature continued

TEMPERATURE CONTROLLERS . . . bulb-and-capillary type, are manufactured by Fenwal Incorporated. Brochure MC-139 gives description, illustrations and specifications on the units, including a diagram showing operation. Units are available in three temperature ranges, three bulb sizes, single or dual control circuits and four basic switch types to meet various requirements.

Circle 292 on Reader Service Card

TRIPLEX PUMP . . . for hydraulic power source, is discussed in bulletin 55TS2 by Kobe, Inc. Unit has unobstructed hand-hole openings which simplify changing of plungers and lines. Spacer-block is designed with telescoping sleeves to prevent fluid from entering crankcase. Operation and detail of unit is completely illustrated.

Circle 293 on Reader Service Card

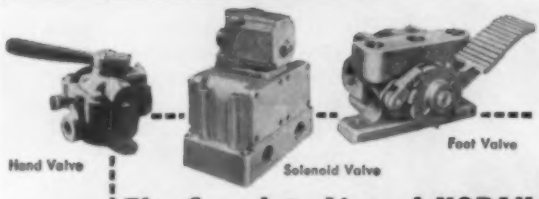
SOCKET SCREWS . . . with self-locking feature, are described in 16-page booklet issued by Standard Pressed Steel Co. Nylok self-locking insert is an optional feature. Booklet describes and illustrates this principle and suggests a variety of possible applications. Complete specifications are given, including technical data on the locking pellet.

Circle 294 on Reader Service Card

MOTOR CONTROLS . . . manual and automatic, are described in 132-page catalog released by Allen-Bradley Company. Guide is conveniently indexed for quick reference to the many types of controls available. Complete operational, dimensional and price data is given. Many types of enclosures are available for damp, hazardous dust and gas locations.

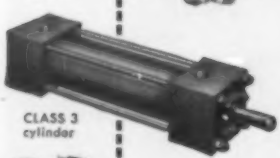
Circle 295 on Reader Service Card

Continued on page 265



The Complete Line of NOPAK Cylinders and Valves

CLASS 1 Cylinder


CLASS 3 cylinder

CLASS 4 cylinder

. . . in various classes of construction and a wide range of sizes and styles . . . meets your every need in the efficient application and precision control of fluid power. Ask your NOPAK representative, or write for catalogs.

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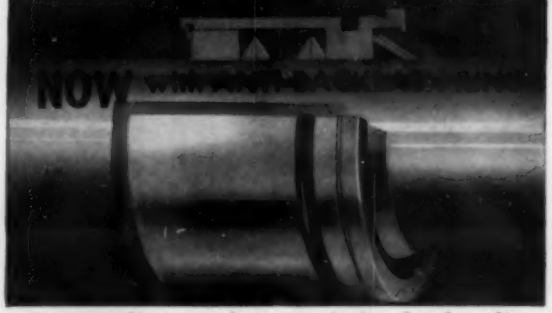
2743 SOUTH 31st STREET • MILWAUKEE 46, WISCONSIN

NOPAK
VALVES and CYLINDERS
for AIR and HYDRAULIC SERVICE

A 8781-1/9

Circle 69 on Reader Service Card

THE ORIGINAL
MONOPAK—CARTRIDGE



A complete packing unit for hydraulic or pneumatic rods or cylinders.

Detailed literature on request.

- **Easily installed or replaced.**
- **Needs no adjusting.**
- **Reduces initial machining expense.**
- **Longer service life.**
- **Includes "Seal-Guard" rod wiper.**
- **Low friction coefficient.**
- **Shock and burst proof.**
- **Cuts machine down-time.**

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

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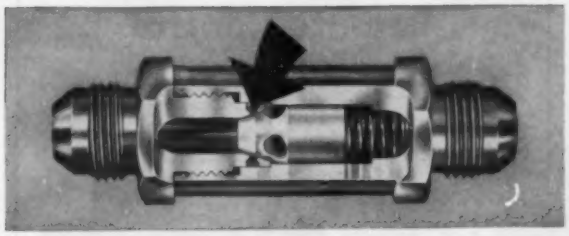
Circle 103 on Reader Service Card

Simple, Secure . . . Leak-Tight!

The FLEXIBLE SEAL SEAT*



Responsive action of the soft O-ring seal provides absolute leak-tightness. Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts; no extra end seals. Stocked in 6 standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Write for data sheet.

KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

Kep-O-seal

HYDRAULIC & PNEUMATIC
CHECK VALVES

* PATENT APPLIED FOR

specify standard

UNBRAKO®

Dryseal-Thread Pressure Plugs

Use them in place of ordinary pipe plugs, or wherever liquids and gases must be contained under pressure. UNBRAKOs seal without compound. They are made of the same high strength alloy steels, have fully formed threads and the same internal wrenching feature as other UNBRAKO socket screws. Standard sizes—1/16" to 1¼"—are stocked by authorized industrial distributors. Ask your UNBRAKO supplier for Bulletin 883. Or write STANDARD PRESSED STEEL CO., Jenkintown 2, Pa.

STANDARD PRESSED STEEL CO.
UNBRAKO SOCKET SCREW DIVISION SPS
JENKINTOWN PENNSYLVANIA

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five important services

★ Hydraulic Presses for the Plastic, Rubber and Engineering Trades. Baling Presses for fibres and metal.

★ High Pressure Pumps, Valves and Accumulators for all industrial applications for oil or water.

★ Extruding Machines for rubber and plastics, with complete ancillary equipment for wire, sheeting and tubing. Injection moulding machines.

★ Greer-Mercier Hydro-Pneumatic Accumulators, Hydraulic Line Shock Alleviators, Gauge Protection Valves, Pressure Switches.

★ Electric, Gas and Steam Hotplates, Heat Circulating Units and Exchangers.

50 TON DOWNSTROKING PREFILLING SEMI-AUTOMATIC PRESS

For plastic Moulding complete with pump and Greer-Mercier Hydro-pneumatic Accumulator. The Press is semi-automatic in operation and is capable of extremely fast cycling having approach speeds up to 3" per second. A feature of the unit is the economical hydraulic power system in which a hydro-pneumatic accumulator provides the necessary high volume for the fast cycling—a small single stage pump being used to keep the accumulator charged during the 'cure period'. Platen areas are 14" x 14" between columns with a daylight of 18".

FAWCETT-FINNEY HIGH PRESSURE PUMPS for oil or water enjoy an enviable reputation for efficiency and long service. The mobile type illustrated, is a single or two stage pump suitable for pressures up to 5,000 P.S.I. and volumes up to 6 g.p.m.

THE GREER-MERCIER HYDRO-PNEUMATIC ACCUMULATOR can provide a smoother and more economical operation of hydraulic systems. A variety of sizes is available for a multiplicity of uses.

FAWCETT FINNEY LIMITED

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Palley's SAVE YOU UP TO 85%

on HYDRAULIC CYLINDERS - VALVES - PUMPS - PARTS, etc. . .

OVER 10 YEARS EXPERIENCE in filling the needs of Aircraft and Heavy Industry led to the development of our own line of outstanding INDUSTRIAL HYDRAULIC CYLINDERS and supplies. We also carry one of the largest stocks of GENUINE GOV'T SURPLUS CYLINDERS, VALVES, PUMPS, MOTORS and Accessories. What we cannot supply we will CUSTOM MANUFACTURE to YOUR specifications.

NEW Palley HYDRAULIC CYLINDERS

All are Double Action with rugged steel construction throughout. Made to stand pressures up to 1500 PSI and 3000 PSI. Utilizes standard 'O' rings in all models and has leather back-up rings in the 3000 PSI types.

PART NO.	BORE	STROKE	SHAFT	P.S.I.	PRICE
P3-4-15E	3"	4"	1-1/8"	1500	$34.25
P-6-15E	3"	6"	1-1/8"	1500	36.75
P3-12-15E	3"	12"	1-1/8"	1500	44.75
P4-5-15E	4"	5"	1-1/8"	1500	39.50
P4-8-15E	4"	8"	1-1/8"	1500	45.75
P4-5-30E	4"	5"	1-1/2"	3000	55.25
P4-8-30E	4"	8"	1-1/2"	3000	61.50
P4-12-30E	4"	12"	1-1/2"	3000	69.75
P5-12-30-1	5"	12"	2"	3000	85.00
P5-24-30-1	5"	24"	2"	3000	115.00

SPECIAL GOV'T SURPLUS HYDRAULICS

40,000 LB. THRUST CYLINDER

A GOV'T SURPLUS BARGAIN! Produces up to 40,000 lb. thrust with a 3000 PSI line pressure. May also be used as a low pressure air cylinder. Has 4" bore, 18" stroke. 30½" long. Navy overhauled – LIKE NEW – **49.95**

VICKERS PISTON TYPE PUMPS

Made to top Aircraft specifications. RPM given below is recommended for constant speed.

PF9-713-20BCE – Delivers 5.3 GPM at 1000 PSI at 3000 RPM – USED **$20.00**

PF9-2713-10Z – Delivers 2.7 GPM at 1500 PSI at 3000 RPM – USED **$22.50**

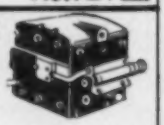
VICKERS HYDRAULIC MOTOR

MF9-713-25BCF–Operates on 8.25 GPM at 1000 PSI at 3750 RPM–USED **$22.50**

2 GPM STRATO POWER PUMP

Positive displacement type. Capacity of 2 GPM at 1400 PSI. Displaces .450 cu. in. per revolution at 3750 RPM in either direction of rotation. Intermittent maximum RPM – 4500. Has a built-in, variable flow control valve in head. Piston type. 1 inch internal pipe ports. **New 27.50**

SPECIAL SURPLUS VICKERS HYDRAULIC TRANSMISSION



Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies hydraulic motor. Has 2 H.P. automatic dash pot for smooth pressure control. Power output is 0 to 1/3 of the input RPM in both directions of rotation. Input RPM is 1800 continuous and up to 4000 intermittent. This is an excellent unit for the operation of Lathes, Duplicator Set-ups, Conveyors, Drives of all types, etc. **ONLY 49.50**

INPUT & TAKE-OFF PLATE ASSEMBLIES

These units permit the adaptation of a pulley input and take-off for the transmission above. They have high speed bearings and 1/2" diameter, shaft with keyway. Easily installed. **10.50 EACH**

4-INCH SPLINE SHAFTS Made to fit the input and take-off shafts of the transmission above. Permits use of gear or pulley drives. **1.25 EA.**

SOON TO BE RELEASED!! 396 PAGE – 1957 CATALOG

IT WILL SOON BE OFF THE PRESSES! IT'S PACKED from COVER to COVER WITH THE MOST FANTASTIC ARRAY OF BARGAINS IN PALLEY'S HISTORY!

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CROWN HYDRA-TROL Remote Control

- Has positive stroke in both directions.
- Does not depend on spring return or outside power sources.
- Immediate synchronization of system in either direction.
- Is a self-contained hydraulic system for positive positioning of remotely-located levers, shafts, and other equipment.

- Valuable in controlling hydraulic valves, winches, throttles, slitting machines, butterfly valves, etc.

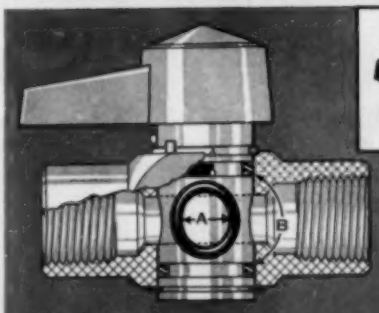
Write for bulletin A describing the control and showing its many uses.

Crown Control Division

of

TRIMOUNT INSTRUMENT COMPANY

3119 WEST LAKE STREET • CHICAGO 12 ILLINOIS



A "O" Ring flow seal provides dead-tight shutoff

B "O" Rings at top and bottom prevent stem leakage

CIRCLE SEAL'S ←

NEW PLUG VALVE

WITH ABSOLUTE LEAK-PROOF SHUTOFF AND "FINGER TIP" EASE CONTROL

Circle Seal now offers a plug valve with entirely new design features! The ingenious use of three "O" Rings **positively** prevents leakage. The handle opens and closes with **absolutely** no effort. The unique design eliminates adjusting nuts and springs making the valve adjustment and maintenance free for long service life.

Wherever you use valves, specify Circle Seal — the finest quality.

For detailed engineering data, write

Circle Seal Products Co.

Incorporated

2181 EAST FOOTHILL BOULEVARD • PASADENA, CALIFORNIA

Circle 135 on Reader Service Card

Circle 42 on Reader Service Card

Useful Literature / continued

PIPE, TUBING, WELDING FITTINGS . . . made from Croloy 5 alloy steel by Babcock & Wilcox Company's Tubular Products Division, are described in bulletin TDC-146A. Folder includes technical information on pipe, tubes and welding fittings of interest to fluid power engineers.

Circle 296 on Reader Service Card

SPRING SEALS . . . for high pressure and high temperature hydraulic service, are produced by Skinner Seal Company. Brochure gives dimensional and technical data and shows cross sections and typical installations of the flexible metallic seals. Operating temperature range to 1200 degrees F and 5000 psi.

Circle 297 on Reader Service Card

For more information on these items use the reader service card bound between pages 178-181

PROXIMITY LIMIT SWITCH . . . manufactured by Square D Company has no moving parts and no metal-to-metal contact is required for operation. Non-magnetic material between the magnetic material and the transducer does not prevent operation. Bulletin illustrates unit and shows typical applications.

Circle 298 on Reader Service Card

V-BELTS . . . featuring twin-grommet construction are described in Bulletin 20B6497C released by Allis-Chalmers Manufacturing Company. Grommet V-belts offer less shrinkage, more stretch, cooler running and better grip. Grommets are buried in thick layer of rubber and belts do not dish under tension.

Circle 299 on Reader Service Card

AIR CYLINDERS . . . manufactured by Modernair Corporation, are featured in their catalog. Larger piston rods are incorporated in 4 and 6-inch bore Provenair series, and a 4-inch cylinder has been added to the Economair line. Complete specifications and illustrations are given on the cylinders and attachments.

Circle 300 on Reader Service Card

Continued on next page

For highest quality
when the pressure's on . . . it's

HELE-SHAW and HYDRAMITE

for constant displacement . . .
HYDRAMITE

- Pressures to 5,000 psi
- Capacities of 3, 5, 10 gpm and up
- No supercharging needed
- Efficiencies over 85%
- Either rotation for direct drive

for variable displacement . . .
HELE-SHAW

- Instantly reversible
- From 0 to 3,000 psi
- Capacities from 3 to 110 gpm
- Infinitely variable discharge
- Many types of controls

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Dept. P-141, Wheatsheaf Lane & Sepviva St., Philadelphia 37, Pa.
CANADIAN SUBSIDIARIES: Affiliated Engineering Corporations, Ltd.

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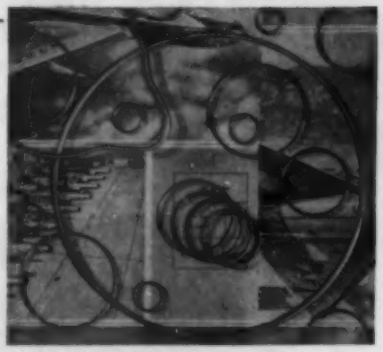
Circle 4 on Reader Service Card

Do You HAVE a "HOT" PROBLEM?

Metal-O-Rings of advanced design

now give you **positive static sealing** with low flange load. For aircraft, atomic energy and industrial high temperature service on fuel, hydraulic, vapor, gas or compressed air lines and connections. Won't deteriorate with high temperatures and pressures, radioactive, electronic, acid or corrosive conditions, most chemicals, oils and greases.



Consider these additional advantages over conventional seals: most complete line, thinner walls, special shapes, lighter weight.

For better products of the future, every design engineer will want this important catalog at his fingertips . . . YOURS for the asking . .

THE ADVANCED PRODUCTS COMPANY

599 Broadway, North Haven, Conn.

Useful Literature continued

TEST GAUGE SELECTION . . . is covered in 8-page catalog No. 400 released by United States Gauge Division of American Machine and Metals, Inc. List of check points is given for ordering pressure gauges and a variety of test gauges for various applications is cataloged.

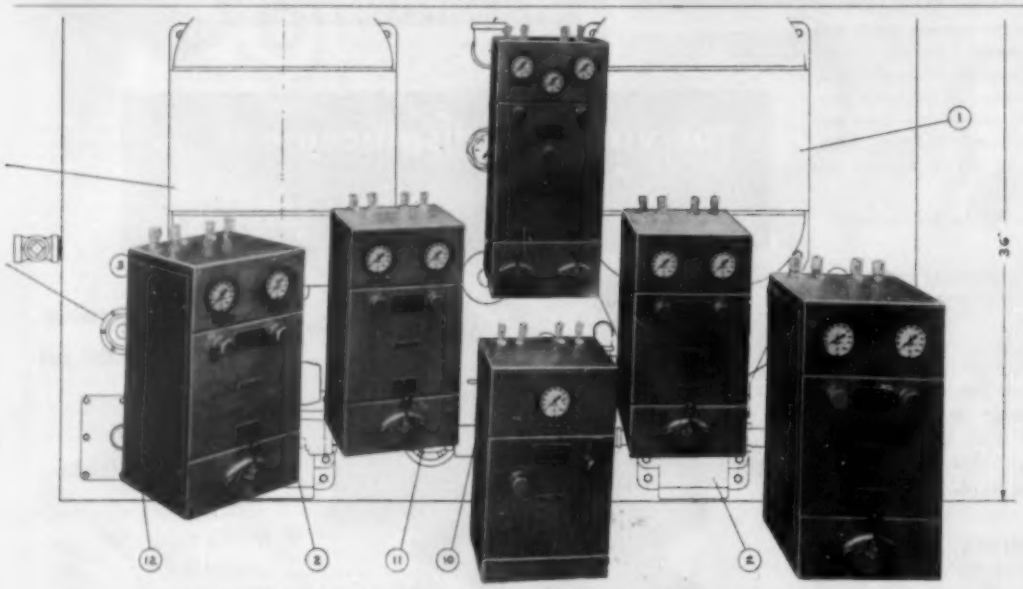
Circle 301 on Reader Service Card

GAUGE SNUBBER . . . to protect high pressure instruments against pressure increments as high as 60,000 psi, is described and illustrated in bulletin available from Chemiquip Company. Porous, corrosion-resistant metal discs are used and the large porous surface resists plugging.

Circle 302 on Reader Service Card

TUBE-WORKING TOOLS . . . are illustrated and described in 24-page catalog 1140 published by Parker Appliance Company's Tube & Hose Fittings Division. In section of booklet entitled "How To Use Tools" complete instructions are given on tube bending and flaring, with pictures of operations.

Circle 303 on Reader Service Card



Cardwell Control Panels incorporate access doors on both sides for minor adjustments. Subplate mounted valves and removable front sections in panels provide maintenance features reducing down time to a minimum.

APPLICATION:
Paper Making Machinery, Printing Presses, Metal Embossing Presses, etc.

The CARDWELL MACHINE COMPANY
Franklin at 19th St., Richmond 11, Virginia • Phone 7-4593
Several attractive territories still open for qualified Hydraulic representatives.

REVISIONS	THE CARDWELL MACHINE CO. RICHMOND, VA.		
	CARDWELL CUSTOM HYDRAULIC CONTROL PANELS		
	DATE 9-21-56	DWN. BY H.L.W.	8269-2
	CHK. BY C.L.H.	SCALE 3/8"=1'-0"	

Circle 160 on Reader Service Card

Now! BAR STOCK BRASS HOSE FITTINGS *That Give You Maximum Flow of Air and Water*

Service Mfg. & Supply Co. J.I.C. union type fittings are available with 37° flare adapters—elbows are 45°, 90°, in standard and long lengths. All fittings are wide aperture and machined from top quality bar stock. This gives you non-porous and maximum flow fittings.

J.I.C. Union type

Special Design—Designing and manufacturing special fittings to your prints is our specialty. In addition, our complete stock of non-porous wide aperture standard fittings will serve your normal needs.

Solid type

Short-Runs—Designing and manufacturing short-run orders is also a specialty of Service Mfg. & Supply Co. Fittings range from any length elbows to special "Y" fittings. Write today for catalog.

"Y" fittings—Standard stock or designed from your prints.

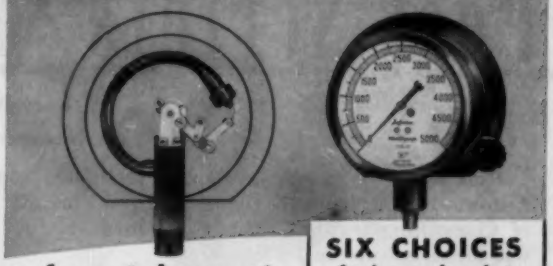
Jobber and agent inquiries invited.

Service Mfg. & Supply Co.

315 East State Fair Detroit, 3, Mich. TWinbrook 3-6565

Circle 115 on Reader Service Card

STAINLESS!



—from inlet to tip

Now the superlative Mastergauge is available in a wider range of corrosion resistant tubes and sockets than any other pressure gauge.

Check the adjoining list. And remember that tube socket and tip are fused into one piece by the exclusive Marsh "Conoweld" process.

Marsh alone combines the "Conoweld" construction, the copper-clad "Marshalloy" case, the finer Mastergauge movement, the Marsh "Recalibrator", the new "Safecase." Ask for data covering your specific needs.

SIX CHOICES *of tubes and sockets*

4130 alloy steel tube with alloy steel tip and socket.

403 stainless steel tube with alloy steel tip and socket.

403 stainless steel tube with 416 stainless tip and socket.

316 stainless steel tube with alloy steel tip and socket.

316 stainless steel tube with 303 stainless tip and socket.

"K" Monel tube with alloy steel tip and socket.

MARSH INSTRUMENT CO., *Sales affiliate of Jas. P. Marsh Corp.* Dept. 19, Skokie, Ill.
Marsh Instrument & Valve Co., (Can.) Ltd. • 8407 103rd St., Edmonton, Alberta, Can.

MARSH "THE STANDARD OF ACCURACY"

More per hour with MEAD WORK FEEDERS

Feed work fast to drill, tap, broach, mill. Delivers, holds, ejects stampings, castings, screw machine parts up to 3"—thousands per hour. Combines with MEAD Timers and Drill Press Feeds for easy, cost-saving automation.

Send for new Air Power catalog today!
(See Thomas' Register for nearest distributor's address, phone number.)

MEAD SPECIALTIES COMPANY

4114 N. Knox Ave., Dept. AH-17, Chicago 41, Ill.

PATHFINDER IN AIR POWER AUTOMATION

CLOSURES

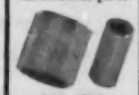
- **Metal or Plastic Caps or Plugs to protect threads, tubes, machined parts, reamers, cutters, tools.**
- **Protect against thread damage, dust, dirt, and moisture.**
- **For inside and outside application. All sizes. Immediate delivery.**

Clover closures are made in metal and tough plastic polyethylene. They are made in caps, plugs and special shapes to fit parts tightly, offering completely sealed protection during manufacture, shipping and storage. Backed by years of closure experience. Write for low prices and complete information.

METAL
Threaded caps for AN & SAE external threaded parts.

PLASTIC
Tapered parts for use either as a cap or plug.

METAL
Threaded plugs for AN or SAE internal threaded parts.



PLASTIC
(L.T. Series)
Non-threaded push-on caps for tubing, AN & SAE Fittings, reamers, etc.

Send coupon today!

Gentlemen:
Please send samples and prices of closures in Polyethylene ☐ Aluminum ☐
Name.....
Address.....
City.....

CLOVER INDUSTRIES, INC. 578 Young Street Tonawanda, N Y

Circle 119 on Reader Service Card

Circle 43 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

Rod Koutnik has joined the **Automatic Controls Division** of **Clary Corporation.** Koutnik was formerly with the Jet Propulsion Laboratory at the California Institute of Technology and recently designed and developed his own line of valves which has been acquired by Clary.

Robert F. Gilman has been appointed production engineer by the **Brooks Rotameter Company,** Lansdale, Pa. **Henry F. Lorence** has been appointed advertising manager.

Brown & Sharpe Manufacturing Company appointed **Frank J. Hoder, Jr.** general manager of its new pump division.

Frank J. Hoder, Jr.
Brown & Sharpe Manufacturing Co.

Minnesota Rainbow Rubber Company, 6651 Highway 7, Minneapolis, has started operations as a wholly-owned subsidiary of **Minnesota Rubber & Gasket Company. Richard Mueller** has been named plant manager.

Richard Mueller
Minnesota Rainbow Rubber Co.

Tuthill Pump Company, Chicago, Illinois, appointed **Atlas Equipment Company,** 620 Meynard Avenue, Seattle, Wash-

ready-made to your specifications

GAR HYDRAULIC RESTRICTORS

Whatever your restrictor requirements, chances are Gar already has units with the characteristics you're after. Gar hydraulic and pneumatic restrictors come in one-way and two-way types, and just about every other type, size and rating you can imagine. But, should you ever ask for special characteristics in pressure, flow, weight, temperature or envelope size that aren't standard at Gar, you'll never know, because we'll produce what you need in the same short delivery time, at the same low price.

Some extras that might interest you, too, for special applications are self-cleaning designs that work, and electroformed orifices that are unique for highest precision and absolutely identical flow characteristics.

But right now, the important thing is to call Gar. After that, you can leave the rest up to us.

RESTRICTORS ★ REDUCING VALVES ★ RELIEF VALVES ★ FILTERS ★ SNUBBERS

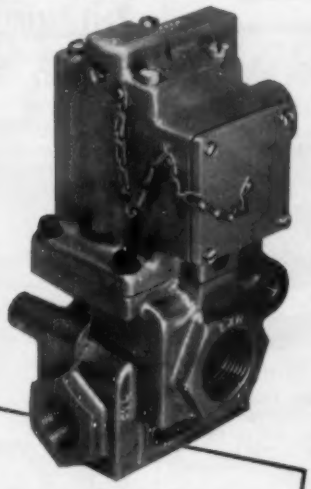
To cover a full range of temperatures, pressures, sizes

Send today for full information **GAR PRECISION PARTS, INC.**
3 LUDLOW STREET, STAMFORD, CONNECTICUT

Circle 21 on Reader Service Card

J.I.C.
IN-LINE
3-WAY
SOLENOID
VALVES

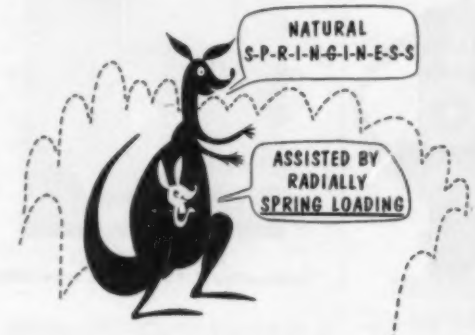
1/4 • 3/8 • 1/2 • 3/4 • 1 • 1 1/4



- NORMALLY CLOSED OR OPEN
- CONTINUOUS DUTY SOLENOIDS
- MOST A C & D C VOLTAGES

Write for Bulletin—Prices

COMPLETE LINE OF
Air Control Values by
AUTOMATIC VALVE CO.
37415 GRAND RIVER AVE • FARMINGTON, MICH.



WIDERS

AN 6231A SERIES
TO
SPECIFICATION MIL-S- 5049
OR
ANY COMMERCIAL DESIGN.

GEO. W. GAYLE & SON
PRECISION METAL PARTS TO SPECIFICATION
FRANKFORT KENTUCKY

Circle 73 on Reader Service Card

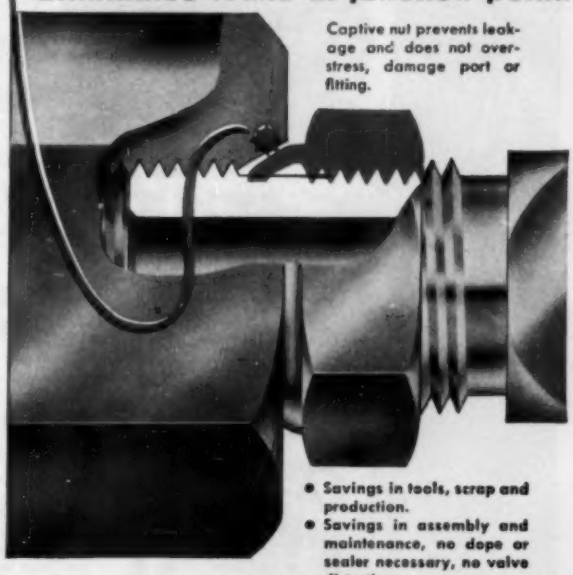
the new L and L . . .

"CN"

straight thread fitting
is your best answer to
Costly Leakage because . . .

- L & L "CN" seals without use of "O" ring.
- Eliminates stress—elbows and tees can be positioned without overtorque of threads.
- Reduces installation time—no need for dope in your hydraulic system.
- Adapted to all hydraulic fluids.
- Assemble and reassemble without damage to port or fitting—assures positive seal.
- *VIBRATION AND HEAT RESISTANT*

Eliminates leaks at junction point.



Captive nut prevents leakage and does not overstress, damage port or fitting.

- Savings in tools, scrap and production.
- Savings in assembly and maintenance, no dope or sealer necessary, no valve distortion.

L and L MANUFACTURING COMPANY
8088 E. Nine Mile Rd., Van Dyke, Mich.

Representatives in principal cities. Write for new literature and full particulars to:

Only L & L gives you a "Complete Fitting Line"

Circle 105 on Reader Service Card

★ *SINCE 1926* ★ *in the application, design & mfg. of pumps — separators — hydraulic accessories.*

EQUIPMENT FOR FLUID POWER TRANSMISSION

Primary Oil Pumps

Class 50 Pumps

Direct connected oil pumps for general pressure circulation of oil. High suction lift; pressures up to 100 psi.
Ask for Bulletin A-1330

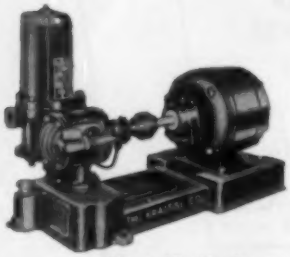
Class 60M Pumps

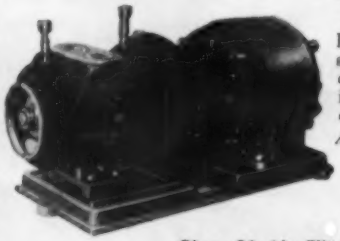
Designed for general industrial oil supply. Direct-connected for light oils, reduction-drive for heavy oils. Capacities to 200 gpm.
Ask for Bulletin A-1267

Vacuum-Powered Transmission and Low-Pressure Air Service

Class 21 & 25 Air Pumps

Oil lubricated pumps —vacuums up to 28" mercury; wide range pressures.
Ask for Bulletin A-1289





Class 23 Air Pumps

Designed for mechanical suction and pressure requirements for the printing and packaging machinery fields.
Ask for Bulletin A-1399

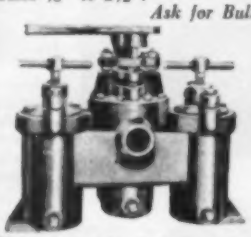
Air Filters

Class 26 Air Filters

Originally designed as integral part of Kraissl oil-lubricated air pumps—now available for independent applications; remove all oil vapors and pipe condensates in compressed air lines.
Ask for Bulletin A-1184

Class 72A Dust Separators

Mounted at vacuum pump intake, minimizes entry of dust, shavings, extraneous matter. Saves its cost in maintenance time. Sizes ⅝" to 2½".
Ask for Bulletin A-1409



Class 72 Separators

Remove extraneous matter from hydraulic circulation lines. Single and duplex strainers and filters—for both standard and high pressure installations. Sizes ¼" to 6".
Ask for Bulletins 1430-1431-1214

KRAISSL CO. Inc.

305 Williams Ave., Hackensack, N. J.

Post Scripts of Industry
continued

ington exclusive sales representatives. Territory includes Washington, Oregon, Montana, Idaho Alaska.

Tube Reducing Corporation appointed **William J. Gemmel, Jr.** sales representative in the Philadelphia area. Territory is Trenton, N. J. to Baltimore, Maryland.

Aero Manufacturing Company, Columbus, Ohio appointed **Eric Denman** as Canadian representative. Denman's headquarters are at 1290 Eglinton Ave., West, Toronto, Ontario.

Two new appointments in the Detroit area were announced by **International Packings Corporation. William L. Harris** is the new branch manager of their Detroit office. **Jack R. Mason** has been appointed as a sales representative.

William L. Harris
International Packings Corporation

Jack R. Mason
International Packings Corporation

Greer Hydraulics, Inc., Jamaica, N. Y. has announced these appointments: **Baboo Ram Teree** chief engineer; **Archie N. Colby** general sales manager;

Baboo Ram "Bob" Teree
Greer Hydraulics, Inc.

Archie N. Colby
Greer Hydraulics, Inc.

Robert E. Williams operational manager and **Floyd Harl** manager of the machine shop. In the service department, **Alfred G. Vassalotti** was named service engineer. **John Farley** has become director of the marketing department. **Norman H. Schwarz** has been appointed sales engineer for the east coast territory.

Gladden Products Corporation, Glendale, California, appointed **Charles E. Rees, Jr.** engineering assistant to the president.

Sprague Engineering Corporation, Gardena, California, appointed **S. G. Morris** representatives in northern Ohio. S. G. Morris has opened their Toledo office at 2639 Upton Avenue. **Charlie Hallett** and **Al LaChance** work from this office, handling the northwestern Ohio territory.

Circle 19 on Reader Service Card

Check the 3 ADVANTAGES Offered by the NEW AUTO-DIESEL GAPLESS Piston Ring

1. REDUCES AIR OR OIL LEAKAGE.
2. LOWERS THE COST OF COMPRESSED AIR.
3. YOU GET A MORE POSITIVE STROKE.

Here is a new patented GAPLESS piston ring that involves a new principal and no other ring can do what it does. It can be adapted for high temperatures by changing the insert. It can be made a contracting ring for sealing shafts, bearings or replacing packing, etc., and many other applications.

POSITIVE SEAL AGAINST BLOW BYS

A positive seal prevents blow bys and the loss of compression. This is very important. Users of pneumatic and normal pressure hydraulic equipment will find that Auto-Diesel GAPLESS Piston Rings will do a better job and last longer. Made in sizes from 2" and up. It will pay to investigate.

Pat. No. 2,738,243 *Write for Details*

THE AUTO-DIESEL PISTON RING CO.
3137 Superior Avenue • Cleveland 14, Ohio
"RINGS and SHAPES Since 1921"

RELIABLE

Differential Piston Type
Relief Valves
3/4" & 1"

DEPENDABLE—RUGGED —built for rough use on mobile equipment

- For oil 1500-3000 P. S. I.
- Also available in ¼" & ⅜" pipe sizes

Write for detailed specifications and prices.

Fluid Controls, inc.

Manufacturers of Hydraulic Valves and Devices
Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

1284 N. CENTER STREET • MENTOR, OHIO

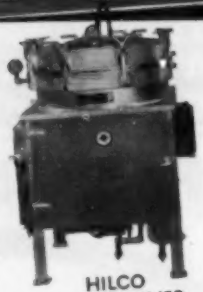
Circle 64 on Reader Service Card

Keep YOUR HYDRAULIC SYSTEM Clean with HILCO HYDRAULIC OIL FILTER

- No More Varnish and Sludge Deposits
- No More Flushing and Manual Cleaning
- No More Frequent Oil Changes
- No More Accumulation of Dirt

Filter life up to a year eliminates usual frequent draining, refilling of systems.

HILCO Hyflow Oil Filters trap dirt, acids, rust, sludge, gums, resins . . . all solid contaminants, and keeps your hydraulic system clean and in top running condition at all times. To you, this means longer oil life, reduced wear and abrasion . . . hence, less down time and lower maintenance costs giving you continuous equipment operation with increased production. Hydraulic unit sensitivity depends upon a clean system. HILCO Hyflow filters remove solids as soon as they enter the system and retain much of the moisture which enters the oil from the atmosphere and from condensation. Obtain the full capacity and economy of your equipment by keeping it in top running condition with HILCO. Hydraulic Oil Filters come in stationary or portable models. They can be hooked into hydraulic systems without interrupting equipment operation.



HILCO
OIL RECLAIMER

For complete oil reclaiming. Removes solids, acids and volatile impurities; moisture, solvents, gasses, etc., from hydraulic fluids by heat-vacuum process.

• SEE FOR YOURSELF HOW HILCO keeps your Hydraulic System Clean . .

WRITE TODAY FOR THIS *Free* BOOKLET

Recommendations at no Obligation

THE HILLIARD *Corporation*

148 W. FOURTH ST. • ELMIRA, NEW YORK

IN CANADA:

Post Scripts of Industry
continued

Duane Shaw has joined the engineering staff of **The Rucker Company,** Oakland, as hydraulic design engineer. Shaw had been a project engineer for the Pacific Car and Foundry Co., Renton, Washington. **Malcolm F. Cliff** has been appointed as a sales engineer for the Los Angeles area. Cliff was formerly Ontario sales manager for Rousseau Controls Company.

Duane Shaw
The Rucker Company

Malcolm F. Cliff
The Rucker Company

Vickers Incorporated has added four application engineers: **John H. Rowland**—Worcester, Mass.; **Paul G. Sullivan**—Pittsburgh, Pa.; **R. C. Lewis**—Summit, N. J.; **Philip A. Kubik**—Cleveland, Ohio.

Francis P. Blonska was appointed administrative assistant in sales by **Cleveland Cap Screw Company,** Cleveland, Ohio. Blonska has been associated with the industry for 21 years.

Circle 88 on Reader Service Card

P. G. Smith has joined **Roylyn, Inc.**, Glendale, California, as assistant to the president. Smith was formerly with Douglas Aircraft, El Segundo, California.

P. G. Smith
Roylyn, Inc.

Allan K. North, as sales engineer, heads the new Toronto, Ontario office of **Adel Precision Products Division** of General Metals Corporation.

John D. Rhule has been appointed staff engineer of The **Teller Company's Automatic Control Division.** Rhule was formerly with the atomic energy division of Westinghouse Electric Corp.

The Cornelius Company, Minneapolis, Minnesota, named **Robert S. Thompson** general sales manager. **J. W. Mahanay** was made manager of aircraft equipment sales and **L. John Buyse** was appointed sales engineer, aircraft equipment division. **Fred Mohl** is manager of portable compressor sales.

Robert S. Thompson
The Cornelius Company

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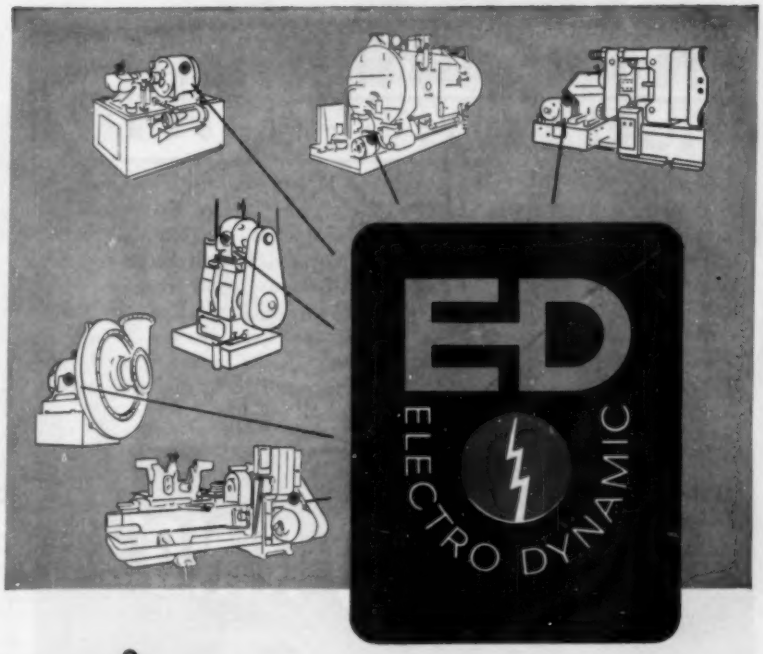
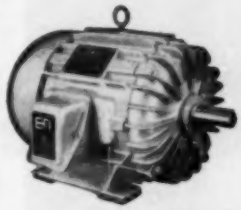
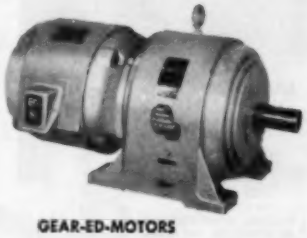




STANDARD MOTORS

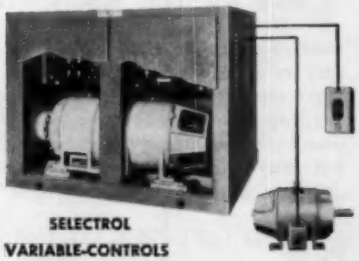
THIS EMBLEM IDENTIFIES EXTRA DEPENDABLE INDUSTRIAL MACHINERY

The red *power spot* on industrial machinery means "Powered by Electro Dynamic." Such machinery relies with confidence on the *extra dependability* of Electro Dynamic motors, the proven industrial motors which give industrial equipment *extra dependable* operation.



GEAR-ED-MOTORS

SELECTRON
VARIABLE-CONTROLS



SELECTROL
VARIABLE-CONTROLS

NEW...
Write for Brochure 50 and literature on new E.D. motors and drives.

Electro Dynamic division of General Dynamics Corporation
Bayonne, New Jersey

GD

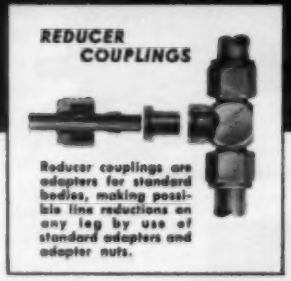
ELECTRO DYNAMIC
Extra dependable motors

Post Scripts of Industry
continued

Flodar Corporation, Cleveland, announces its entry into the export field and appointed **C. O. Brandes, Inc.,** 4900 Euclid Avenue, Cleveland, Ohio, as their world representative. Export distributorships are being set up by the Brandes organization.

The Texas Company appointed **R. J. Ronan** regional manager, technical services, with headquarters in Beacon, N. Y. home of Texaco Research Center. Ronan has charge of technical services for industries in 14 eastern and middle Atlantic states.

LENZ "O-RING"
NO METAL TO METAL SEAL
J.I.C. APPROVED
HELD BY FRICTION GRIP OF THESE TWO
NO CONCENTRATION OF STRESSES DUE TO FLARES OR FERRULES FOR TUBE FAILURE
NO EXACT TUBE LENGTH NECESSARY
NOT NECESSARY TO CUT TUBE SQUARE
SEAL AND GRIP ARE SEPARATE


REDUCER COUPLINGS
Reducer couplings are adapters for standard bodies, making possible line reductions on any leg by use of standard adapters and adapter nuts.

...A Hacksaw And A File Are All You Need

Excessive wrench torque is unnecessary for seal does not depend upon tightness of the nut. The higher the pressure the tighter the grip. Solve your hydraulic piping problems the easy way . . . with ease of assembly . . . no matching of exact tube lengths . . . simple leakproof connection for the life of the tube.

Reusable collet holds by friction grip up to bursting pressure of tubing.

LENZ FITTINGS MAKE THE JOB AS SIMPLE AS A B C

LENZ COMPANY

See our Catalog Page in Thomas Register 1956 Edition, Vol. 1, under classification "Fittings: Hydraulic" for complete list of types and sizes.

BOX 1044-A • DAYTON 1, OHIO

PHONE: ORegon 9364 • 3303 KLEPINGER ROAD

DISTRIBUTORS IN PRINCIPAL CITIES

Hannifin Corporation, Des Plaines, Illinois, has divisionalized its sales operations and appointed these division sales managers: **Robert G. Broberg**—air and hydraulic power cylinder division; **William C. Thompson**—air valve division; **Arnold W. Blackshaw**—machinery division, air and hydraulic presses and portable hydraulic power tools.

Robert G. Broberg
Hannifin Corporation

William C. Thompson
Hannifin Corporation

Arnold W. Blackshaw
Hannifin Corporation

Four new sales representatives were appointed by **The Hilliard Corporation,** Elmira, N. Y.: **Lynn McGuffy Company,** 2330 Sul Ross, Houston, Texas and 304

Continued on page 276

Circle 156 on Reader Service Card

AT LAST! A heavy-duty air-operated Hydraulic Boost Pump with positive operation, high fluid capacity, and long life!

The new S.C. 10-304 Hydraulic Boost Pump has licked the problem of balky pump operation. A spring offset automatically positions the air actuating valve on the power stroke. This feature, plus an automatic sequence of operations, make it *impossible to stall or stop the pump,* assuring positive, continuous operation.

Simple, trouble-free operation—The valve assembly is made of corrosive-resistant steel, heat treated for long life.
Accommodates either oil or water—for both testing and powering of equipment.
Minimum air leakage—Both valve and sleeve are precision honed for closer fit; smoother operation.
Maintains desired pressure automatically—Operates often enough to replace any fluid which has leaked from the system.
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Output capacities—From two gallons per minute at 1000 p.s.i. to 23 cubic inches per minute at 30,000 p.s.i.

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- male pipe threads
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- Aro
- Lincoln
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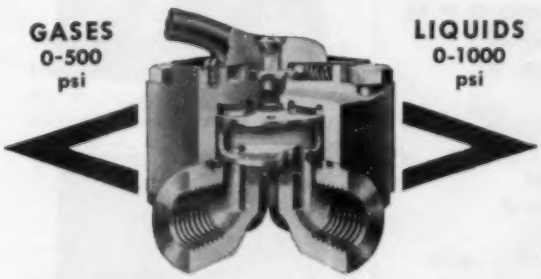

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- 2, 3, 4-way
- Turning ease
- Zero leakage
- Increasing pressure tightens seals.
- Positive flow control

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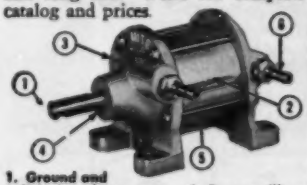
Low Cost... Compact... Powerful... Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types

AIR-MITE Devices, Inc.

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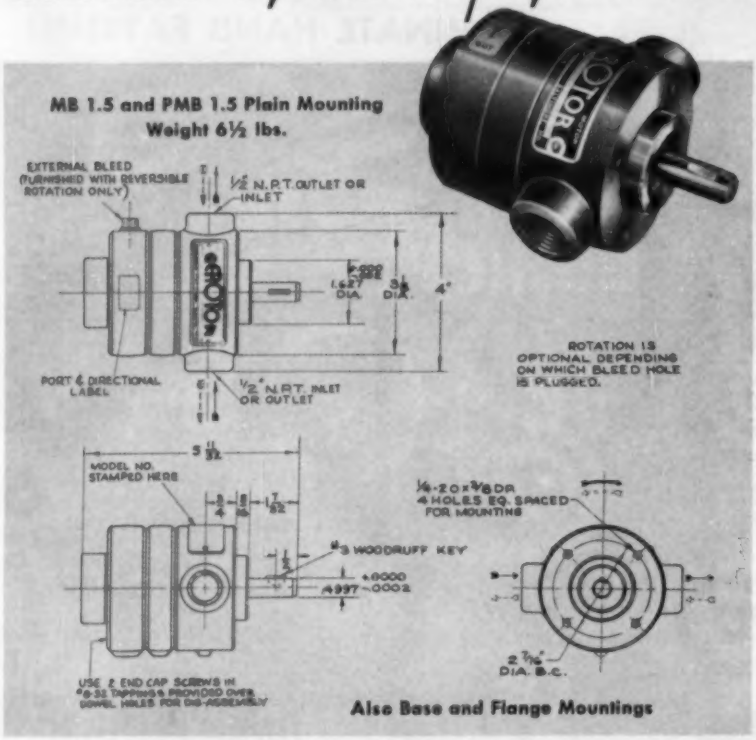
Circle 6 on Reader Service Card

Hydraulic PUMP-MOTOR delivers 2,000 P.S.I./5,000 R.P.M.


MB 1.5 and PMB 1.5 Plain Mounting
Weight 6½ lbs.
EXTERNAL BLEED (FURNISHED WITH REVERSIBLE ROTATION ONLY)
½" N.P.T. OUTLET OR INLET
GEROTOR
1.627 DIA.
3½ DIA.
4"
PORT & DIRECTIONAL LABEL
½" N.P.T. INLET OR OUTLET
ROTATION IS OPTIONAL DEPENDING ON WHICH BLEED HOLE IS PLUGGED.
MODEL NO. STAMPED HERE
#3 WOODRUFF KEY
.4997 +.0000 -.0002
⅜-20 x ⅜ DP 4 HOLES EQ. SPACED FOR MOUNTING
2 7/16" DIA. B.C.
USE 2 END CAP SCREWS IN #6-32 TAPPING'S PROVIDED OVER DOWEL HOLES FOR DIS-ASSEMBLY
Also Base and Flange Mountings

New GEROTOR MB-PMB 1.5 PUMP-MOTOR opens wider horizons to the hydraulic designer

Usable as pump or motor, this compact power package delivers—

- 2,000 P.S.I.—5,000 R.P.M.
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- 10-1 Speed Range, at Constant Torque
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GEROTOR

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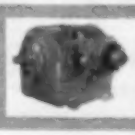
Variable Speed Hydraulic Transmissions

PneuBin—Pneumatic Bin Evacuators

Post Scripts of Industry
continued

Sklar Building, Shreveport, Louisiana—east Texas, southern Arkansas, northern Mississippi and northern Louisiana; **Ember Products, Inc.,** 252 Fort Lee Road, Leonia, N. J.—Metropolitan New York and Connecticut, **C. Arthur Weaver Company, Inc.,** 403 East Franklin St., Richmond, Virginia—Virginia; **General Equipment Company,** 616 Hyde Building, Spokane, Washington—eastern Washington and northern Idaho.

Louis G. Jordan has been named assistant chief engineer for industrial products at **Vickers Incorporated,** Detroit. **Carl A. Brown** has been appointed assistant chief engineer for automatic systems.

Louis G. Jordan
Vickers Incorporated

Carl A. Brown
Vickers Incorporated

Louis L. Jewel was appointed Buffalo district sales manager, mechanical goods division of **United States Rubber Co.**

E. L. Oehling was promoted to general sales manager, and **R. J. Lindsey** to vice president, engineering at **The Hydraulic Press Mfg. Company** division of Koehring Company.

E. L. Oehling
The Hydraulic Press Mfg. Co.

R. J. Lindsey
The Hydraulic Press Mfg. Co.

Milo Harrison Buzzee has joined **Tube Turns Plastics, Inc.,** Louisville, Kentucky. He will direct the marketing of custom molded products and handle special assignments.

Minneapolis-Honeywell Regulator Company's Valve Division announced construction of a new three-acre manufacturing plant and home office at Fort Washington, Pa. The 120,000 square-foot building will house the entire manufacturing, sales, research, development and administrative facilities of the division, now located in Philadelphia.

The W. L. Maxson Corporation appointed **F. D. Vieth** as western district manager, with offices at 8840 Olympic Blvd., Beverly Hills, California.

Continued on next page

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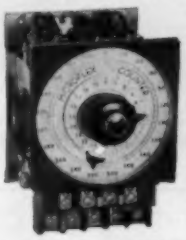

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400 COUNT RANGE — accuracy ± zero

1000 COUNT RANGE — accuracy ± 1 count

(Bulletin 720)

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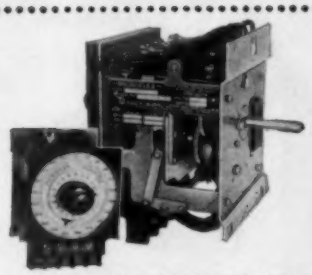
- RESETS AUTOMATICALLY

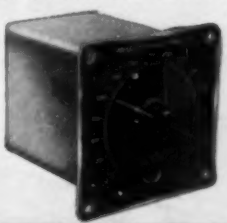


MICROFLEX

REVOLUTION SHAFT DRIVEN COUNTER

(Bulletin 723)

- COUNTS UP TO 1200 REVOLUTIONS RESETS AUTOMATICALLY
- ACCURATE WITHIN 1 INCREMENT
- TORQUE REQUIREMENTS — 5 INCH OUNCE OR LESS



COUNT SWITCH - Manual Set

(Bulletin 780)

- IDEAL FOR TOOL LIFE APPLICATIONS
- AVAILABLE WITH 1, 2 or 3 SWITCHES
- COUNTS FROM PREDETERMINED SETTING TO "0"
- AVAILABLE UP TO 54000 COUNTS
- REPEAT ACCURACY — 1% OF FULL SCALE RANGE. 72 COUNT SWITCH — NO ERROR
- SMALL, COMPACT
- SOCKET-TYPE CONNECTION OPTIONAL

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Industrial Timers Division, Dept. AH-157
MOLINE, ILLINOIS

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☐ Bulletin 723 (Microflex Shaft Driven Counter)
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Circle 15 on Reader Service Card

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Post Scripts of Industry
continued

Eastern Aircraft Products Corporation, Orange, N. J., has announced appointment of **W. R. Watkins Company, Limited,** 41 Kipling Avenue South, Toronto, Ontario, as exclusive sales and engineering agents in Canada.

Precision Rubber Products Corporation, Dayton, Ohio, has named two branch managers: **Vernon E. Beattie**—Kansas City branch office, territory of western Missouri, Kansas and Nebraska; **William K. Figley**—Chicago office covering western Indiana, northern Illinois and Iowa.

Vernon E. Beattie
Precision Rubber Products Corp.

William K. Figley
Precision Rubber Products Corp.

William Kujala is new eastern district sales manager for **Gits Bros. Manufacturing Co., Shaft Seal Division.** Kujala's headquarters will be Gits Bros., new branch office at 36 Grand Avenue, Englewood, N. J. Territory includes New England, New York, New Jersey and eastern Pennsylvania.

Circle 201 on Reader Service Card

Thomas W. Johnson was elected vice president of **The New York Air Brake Company.** Formerly with Bendix Aviation Corporation's Eclipse Pioneer Division, Johnson joined New York Air Brake in 1953.

Thomas W. Johnson
N. Y. Air Brake Co.

The new distributors were appointed by **The Flodar Corporation,** Cleveland, Ohio: **J. A. Postell,** Atlanta, Georgia—southeastern area, with complete warehousing; **Clem Weston Company,** New Orleans—Mississippi, Louisiana and Arkansas, with warehousing in New Orleans and Shreveport.

Jack P. Anderson was named chief industrial engineer of the **Lunkenheimer Company,** Cincinnati, Ohio. Previously, Anderson was with O. A. Sutton Corporation of Wichita, Kansas.

American Engineering Company, Philadelphia, appointed **Vernon A. Olson** as sales manager of their marine and hydraulics division.

Vernon A. Olson
American Engineering Co.

Conoflow Corporation of Philadelphia has appointed **Albert J. Hanssen** chief engineer. Hanssen was formerly chief engineer of Climax Division, Black, Sivalls & Bryson, Inc.

Four exclusive representatives were named by **International Packings Corporation,** Bristol, New Hampshire, in the following territories: **Harold Adams**—western New England, including Connecticut, Rhode Island, Vermont, western Massachusetts and western New Hampshire; **Kenneth Dick**—eastern New England, including Maine, eastern Massachusetts and eastern New Hampshire; **William Duckworth**—New Jersey, Maryland, Delaware, southern New York and eastern Pennsylvania; **James Hamer**—Kentucky, Tennessee, southern Indiana, southern Illinois, eastern Missouri, northern Mississippi and northeastern Arkansas.

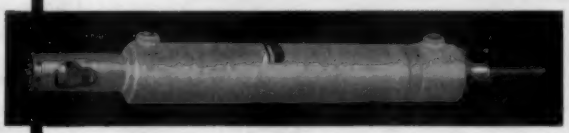
BHEW

Custom-Built
HYDRAULIC CYLINDERS

Made-to-order to meet specific design requirements for any application in any industry.

Compactness! Efficiency! Close Tolerances! Outstanding operational performance! You get them all in BHEW cylinders. They require minimum mounting space. There is no tooling charge for BHEW cylinders, built to meet *your* specifications and delivered on schedule.

BHEW cylinders are available in standard and special O.E.M. designs . . . single or double acting and telescopic; 1½" to 8" bore; strokes up to 156"; oil hydraulic service in 1,500 psi or 3,000 psi working pressure, pneumatic up to 150 psi; cup-type, ring-type or O-ring construction; choice of mounting.



1 Cylinder barrel and non-adjustable gland welded into one piece, eliminates joint, makes small O.D. in large single and double-acting hoist cylinders.

2 Accurately honed barrel.

3 Hard chrome-plated rod.

4 Flow regulating or pilot operative check valve in base, when required.

Send us specifications of your requirements, for full information.

Got a design problem involving cylinders? Our extensive engineering service is available to you without charge.

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622 Langley Avenue, St. Joseph, Michigan

6 WAYS TO GUARD YOUR HEART

1 See your doctor

2 Control your weight

3 Get enough rest

4 Keep physically fit

5 Ease up—and relax

6 Help fight heart disease

HELP YOUR HEART FUND — HELP YOUR HEART

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At least five years experience in the manufacture and assembly of high pressure piston type oil pumps. Must be capable of supervising both assembly and test of this equipment. Excellent opportunity. Permanent. Salary open. Reputable manufacturer. Location Eastern Seabord. Replies confidential. Write APPLIED HYDRAULICS, Box 2157.

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We have 1700 valves still on skids from the original manufacturer. Here are the specs:

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Replacement parts available
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While they last: $3.00
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High-pressure hydraulics, West-German dependable designs, adjustable pumps and fluid motors, max. pressure 4978 psi, normal pressure 2133 psi, also combined to variable speed drives for mobile and stationary equipment. To be licensed to US manufacturers. Write APPLIED HYDRAULICS, Box 1157.

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Some men have the courage to send their imaginations "up-ahead" to find the way to new destinations —or problem solutions. Such men compose our engineering staff here at ROSS. Valves and circuitry to bring air-power's economy and efficiency to new operations are always coming out of these efforts. The result: ROSS job-engineered valving grows more popular daily; so these men's ranks need expanding. Can you qualify to join them. If you are resourceful, experienced and have a *pioneering imagination* this is your invitation to contact Ross Operating Valve Company, 120 E. Golden Gate, Detroit 3, Michigan to discuss home office work. For field work, contact your nearby ROSS representative.

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Your Surplus
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Will buy all makes flared or compression. Especially interested in Weatherhead and Imperial Ermeto steel compression type fittings.

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Phone: INdependence 3-3925

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Rebuilt Greer Hydraulic, Fuel, and Combination Test Stands. Flows up to 24 gpm and Pressures up to 4000 psi.
Also available—Vickers Power-Pac
(2) 70 gpm Pumps
—150 hp Motor
A & J. Machinery Corporation
1267 Flushing Avenue
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Top level industrial sales experience with air and hydraulic components and special machines. Background in Tool Engineering and hydraulic and electrical circuitry. Established contacts in Detroit and out-state area. Seeking high potential connection. Will relocate. Age 34, college, family, personable. Write APPLIED HYDRAULICS, Box 3157.

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A well established midwestern manufacturing firm has an exceptional opportunity for a qualified engineer with a background in hydraulics. The person selected will be the top engineering executive directly responsible to top management.
Requirements:

- An engineering degree or equivalent.
- A basic knowledge of hydraulics and their application in industrial and automotive fields.
- A successful record of accomplishment, particularly in engineering administration.
- Age, 35 to 40 years.

Compensation, $15,000 to $18,000 based upon experience and accomplishment.
All replies handled in confidence. Write APPLIED HYDRAULICS, Box 5157.

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solve problems in atomic propulsion

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FIRST IN ATOMIC POWER

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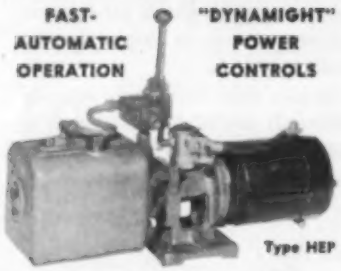
"DYNAMIGHT" POWER CONTROLS



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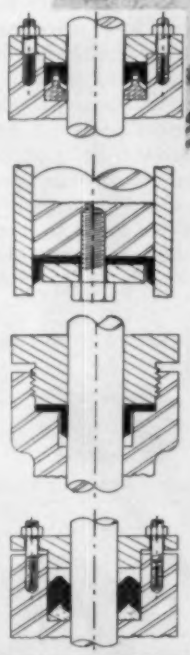

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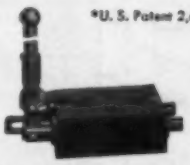

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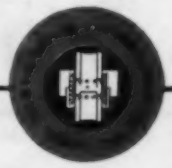

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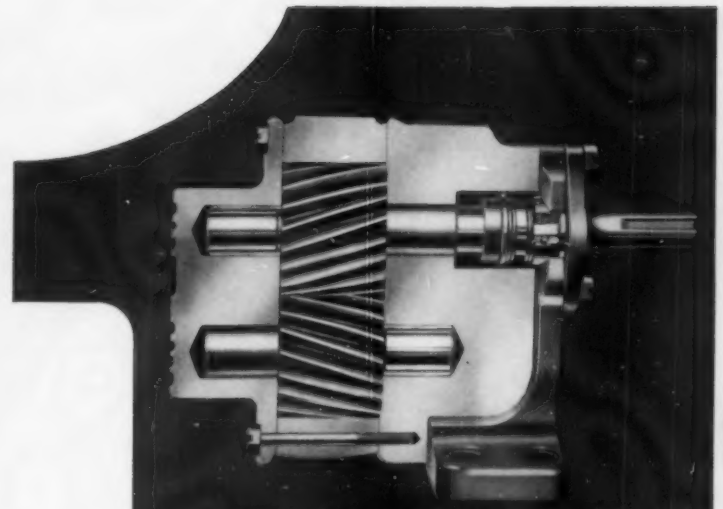

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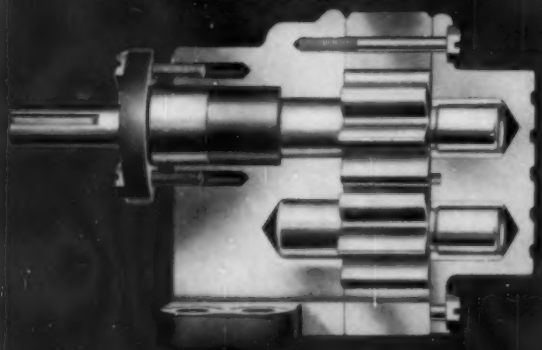

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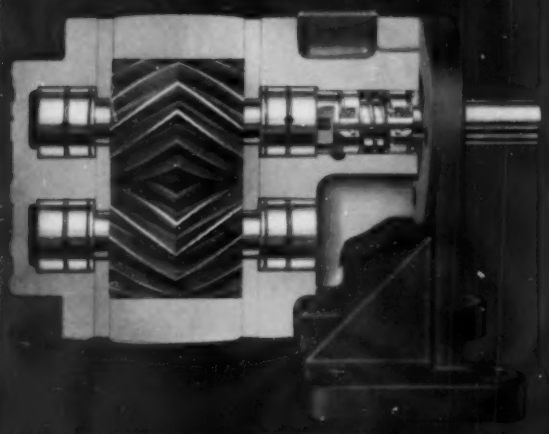

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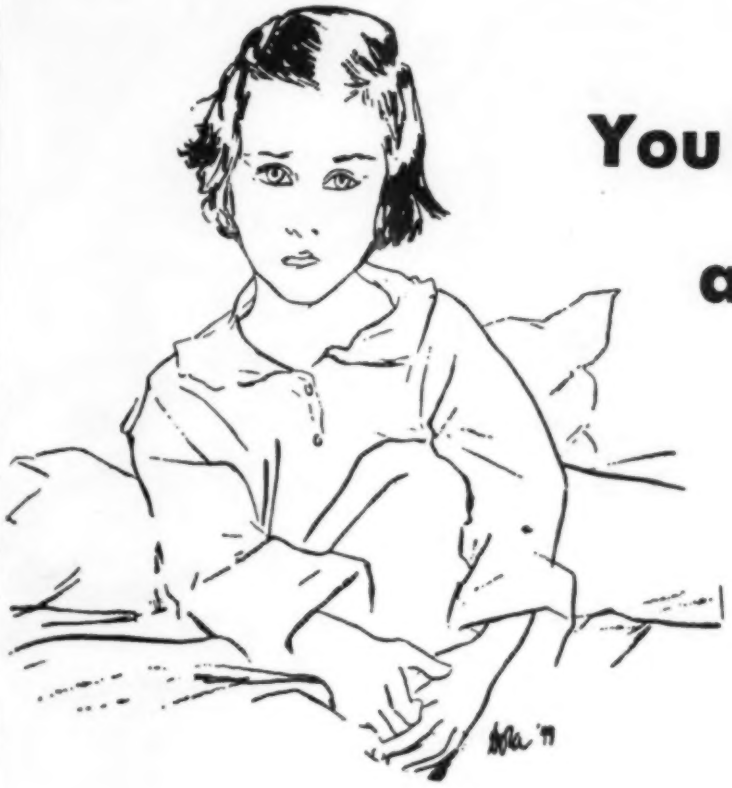

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